

Life on a Raft

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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SEE PAGE 7

BUY UNITED STATES
WAR SAVINGS
BONDS AND STAMPS





INTAKE SILENCER
FOR NAVY DIESEL
ENGINES—built by
AC since 1934

HUSH HUSH *for Sea Horsepower*

SEA-GOING diesel engines breathe with a constant roar. Transmitted through the intake system, this racket would be hard on engine-room crews. So, many of the diesels of our Navy are hushed by special AC intake silencers.

No adjustments are possible. Silencers must be *right* when they leave the AC production line. So, accurate, painstaking workmanship is demanded.

In spite of all this, Navy thoroughness requires regular checks on silencers—to keep them up to standard.

Your Fuel Pump, too, Needs Attention

The fuel pump on your car, truck, or tractor is blood brother to this silencer in its need for occasional care. Because it is precision built, it, too, gives trouble

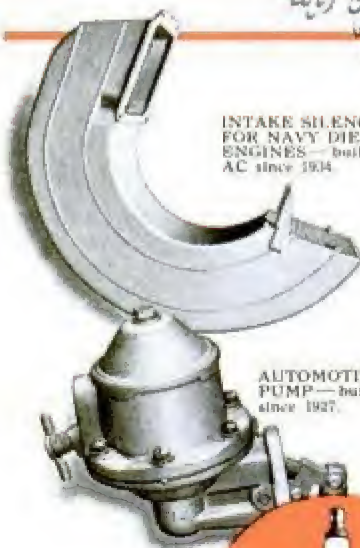
very seldom. But, its life can be definitely prolonged—and your transportation protected—if you will have your service man check your pump after thirty thousand miles of use.

Automotive repair shops can give Conservation Service, not only on fuel pumps but on all nine AC products. (The details of this service, and of why you need it, are given briefly below.) To conserve badly needed materials, gasoline, oil, and tires, use this service—faithfully.

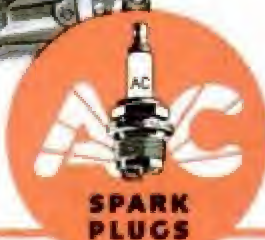
When replacement becomes necessary, select AC—for complete satisfaction.

Awarded to the men and women of AC on September 2, 1942, for outstanding achievement in producing for Victory.

AC SPARK PLUG DIVISION
GENERAL MOTORS CORPORATION



AUTOMOTIVE FUEL
PUMP—built by AC
since 1927.



SPARK PLUGS

SPARK PLUGS—Dirty or worn plugs waste as much gas as one coupon in ten. Oxide coating collects on the plugs and causes them to misfire, especially when the engine is working hard. Dirty plugs also cause hard starting, which weakens your battery. Under present slow driving conditions, have your plugs cleaned and adjusted every few months.



AIR CLEANERS—A dirty air cleaner increases gasoline consumption because it chokes down the flow of air into the carburetor. Your air cleaner should be rinsed whenever your car is lubricated.



FUEL PUMPS—Practically trouble free. But, if yours has been in use thirty or forty thousand miles, it

may be worn to the point where a check-up is due.



DRIVING INSTRUMENTS—Speedometer, gasoline gauge, oil pressure gauge, ammeter, and temperature gauge seldom need service. But, if they give trouble, have them cared for at once.



OIL FILTERS—Slow driving accelerates formation of soot and carbon in engine oil. If not constantly filtered from the oil, this dirt will clog piston rings, cause increased consumption of oil and gas. So, replace your oil filter element whenever your dealer's AC Oil Test Pad shows that your oil is dirty.

BRING VICTORY QUICKER.—BUY U. S. WAR SAVINGS STAMPS AND BONDS

**'WAY BACK IN 1940,
THEY WERE RUNNING ON
B.F. GOODRICH SYNTHETIC TIRES**



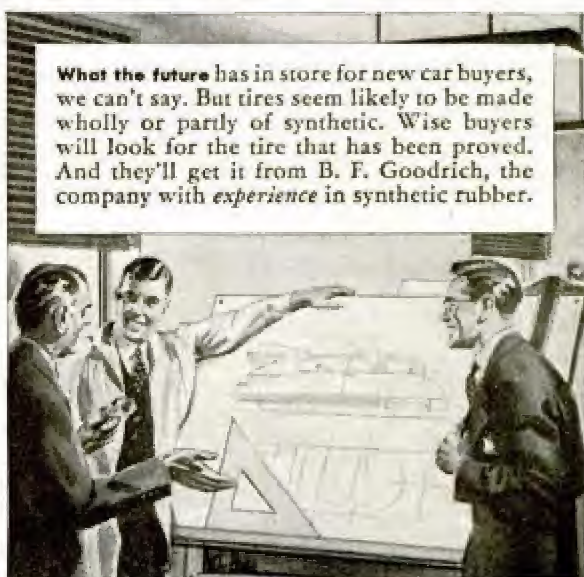
"Thousands of these tires were sold then. One of my suppliers bought 'em ... and so did scores of other companies. Private car owners, too. It *proved* that synthetic was okay!" This grocer *knows*—for Standard Brands put B. F. Goodrich tires (in which more than half the rubber was synthetic) on company cars. Some of these tires ran for more than 30,000 miles. This was the greatest tire test ever made.



Your War Bonds help to pay for the synthetic rubber used by our armed forces. Jeeps run on it, fighter planes land on it, and guns move on it. Synthetic rubber is used in self-sealing fuel tanks for planes, too. That's why everybody can't have synthetic rubber tires now.



What the future has in store for new car buyers, we can't say. But tires seem likely to be made wholly or partly of synthetic. Wise buyers will look for the tire that has been proved. And they'll get it from B. F. Goodrich, the company with *experience* in synthetic rubber.



**LISTEN TO JOSEPH C. HARSCH
in "THE MEANING OF THE NEWS"**

OVER THE COLUMBIA BROADCASTING
SYSTEM EVERY NIGHT, MONDAY
THROUGH FRIDAY



Inside Information by
a man who has lived
where the news is
being made



In war or peace
B.F. Goodrich
FIRST IN RUBBER

SECONDS LATER THE BIG ONE CAME!

A true experience of Mr. and Mrs. James Sproston, of Cheshire, during the big air blitz over England.



1 Night after night they heard the great German Heinkel bombers roaring directly overhead, Liverpool-bound and loaded with bombs. Then one night Jerry was late. Feeling safe, the elderly English couple prepared to retire. Suddenly the sirens began to shriek...



2 Came the rumble of jettisoned bombs. Sproston grabbed up his flashlight. He and his wife hurried downstairs to black out the windows. The next moment an explosion shook the house. Seconds later the big one came...



3... Half demolished the house and threw its stunned occupants violently to the floor... Some time after, two passing air wardens saw a light shining out of the wreckage. It was the beam from Sproston's faithful flashlight—a beam that directed the rescue of two more victims of the Luftwaffe's ruthlessness.

SPARE YOUR FLASHLIGHT BATTERIES!

For your own emergency protection (witness the Sproston's experience) as well as to conserve critical war materials, use your flashlight normally as little as possible. Make a habit of flashing it *intermittently*, not *continuously*. Also:

If you can't get "Eveready" flashlight batteries, don't blame your dealer. The Army, Navy and Lend-Lease get first call on the supply, and few are left for civilians.

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Unit of Union Carbide and Carbon Corporation



The word "Eveready" is a registered trade-mark of National Carbon Company, Inc.

FRESH BATTERIES LAST LONGER...
Look for the DATE-LINE



Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

September, 1943

Vol. 80, No. 3

Next Month

WHENEVER bomber pilots get together they swap yarns about Alexander the Swoose, Dry Martini, Werewolf, Thunderbird and scores of other famous Flying Fortresses that have performed the miraculous in getting their crews back to home base without benefit of fighter escort. If you sat in on one of these sessions you'd hear how the Werewolf fluttered back from Brest on one engine after all save the pilot bailed out, and the amazing story of the Thunderbird that got home with its fuselage ripped in half. A thrilling October story of how they do it—"The Bomber That Fights Anything"—is told in the words of the men who were there.

New War Baby

AFTER the last war it was radio. This time it's television—the war baby of World War II. You don't have to be an expert to predict that postwar television sets will be static free and have one knob to tune in both sight and sound. They are now in use, and wait only the last shot in Berlin or Tokyo to get into production. For a behind-the-scenes account of this infant read "Television—the New War Baby" next month.

Cotton Goes to War

MOST persons think of cotton as something used only for making cloth, but it is second only to steel in the list of vital war materials. Without it, America's war production would halt and guns would stop firing. "America's No. 1 War Crop," an important October article, tells of the thousands of ways King Cotton is at war.

IN THIS ISSUE

Aleutian Springboard	1
Life on a Raft	8
America's "Silent Service"	18
Battle Log of the Liberators	28
Industry's Mr. Fix-It	34
Uncle Sam Packs a Wallop	40
Featherweights of the Navy	50
Golden Harvest of the Sea	55
The Battle for Rubber	61
The 1943 Bucket Brigade	66
Free Meat—Come and Get It!	72
West Point at War	82

Where-to-Buy-It Index Starts on Next Page

"They Pack the K.O. Punch"

UNCLE SAM'S new 35,000- and 45,000-ton battleships are the most powerful ever built. They hurl a 2,400-pound shell for 20 miles, and with uncanny fire control can blast the enemy out of the sea before he knows what hit him. The Japs found this out one night when three of their cruisers moved in for the kill on what they thought was a lone American cruiser. An October article on the new giants of the fleet tells what happened when the trapped "fox" turned out to be a "bear" in the form of one of our super dreadnaughts.

Your Airplane for 1953

ONE decade hence, it may not be unusual for a New York businessman to close his desk on Friday and inform his secretary that if she wants to get in touch with him over the week end he will be in Moscow. In an article next month, R. S. Damon, president of Republic Aviation Corp.—the company that builds the Thunderbolt—predicts that passenger-carrying "Planes of 1953" will approach the speed of today's pursuit ship. As a practical aeronautical engineer, he visions great stratosphere liners for long trips, family planes by thousands.

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City or Town State

WHERE-TO-BUY-IT INDEX

Where no name and address appear directly under an item, the product is not believed by us to be commercially available

Arctic winds run soldier's washer.....	6
Mobile "155" knocks out tanks.....	6
Sentry box mounted on truck.....	6
Rocket gun used by Russians.....	7
Table shows how far pilot can see.....	7
Helicopter lands on deck of ship.....	13
Sea water made safe to drink.....	13
Mirror and ray align gun sight.....	16
Molecules give punch to blockbusters.....	16
Navy uses plastic tableware.....	16
Machine shows tire's centrifugal bulge.....	17
Rangers cross tightrope bridge.....	17
Motorized preflight trainer.....	25
Merry-go-round tests bullets' weight.....	26
Naval battle reproduced on table top.....	27
Wartime home built for \$1,000.....	33
"Electric Tuna" gives fishing practice.....	33
Wooden copyholder for typist.....	38
Wells Office Furniture Co., 410 S. Wells St., Chicago.....	38
Tamperproof box for fire extinguisher.....	38
American-LaFrance-Foamite Co., Elmira, N. Y.....	38
"Ready Wrapps" for gift packages.....	38
Bill Y. James, Miami, Okla.....	39
Rocking barge tests ship's guns.....	39
Hammock for jungle fighters.....	39
Hoghead shelter for sentry.....	44
Travelodge Corp., 1120 Madison St., Lynchburg, Va.....	44
Rubber stamps save draftsman's time.....	44
Three-blade adjustable hole cutter.....	45
Robt. H. Clark Co., 3424 Sunset Blvd., Los Angeles, Calif.....	45
Blimps poised for flying takeoff.....	45
Kitchens adroit.....	46
Giant models show uses of instruments.....	46
Ten billion jolts test grip of nut.....	46
"Spinner" resets thermometer.....	46
Les-Age-Motive Co., Manteno, Ill.....	49
Ben Franklin's fireplace stove.....	49
Outdoor garage on Alaska Road.....	54
Transparent test chamber.....	54
Quartz rod lights cigarette.....	54
Cellulose hoods seal plane pipes.....	60
Sailors practice rowing in "land boat".....	60
Control truck guides air students.....	60
One-man toe-in gauge for tires.....	60
Testing Apparatus, Inc., 1627 W. Port St., Detroit, Mich.....	65
Interlocking shingles defy wind.....	65
The Ruberoid Co., 500 Fifth Ave., New York.....	65
Vest pocket cars to burn aviation gas.....	70
Hydraulic jack for plane tire.....	70
New type of synthetic rubber.....	70
Zone map guides deliveryman.....	71
Gun crew must have teamwork.....	71
Sixty dollar electric "kiddle car".....	77
Glass made without sand.....	77
Silken wings for supermen.....	78
Homemade cultivator.....	80
Hose horse directs stream of water.....	80
Met-L-Top Tables, Inc., Milwaukee, Wis.....	80
Ointment prevents sunburn.....	80
Squeakless wooden door hinge.....	80
Whitehouse Research Bureau, 101 Park Ave., New York.....	81
Aircraft makers build own tools.....	81
Model glider has "low control".....	88
Berkeley Models, Inc., Brooklyn, N. Y.....	88
Hang-fire test for cartridges.....	88
Anti-sneeze solution.....	88
Hole digger mounts on tractor.....	88
Equipment Sales Co., 627 State St., Madison, Wis.....	88

Craftsman and Shop Notes Index

ART AND ARTIST

Brush rack from plastic tumbler.....	91
Soap holds tissue on board.....	92
Keeping pencils handy at drawing board.....	102
Portable drawing board.....	127

AUTOMOTIVE

Testing generator on drill press.....	96
Replacing damaged muffler.....	97
Simplified auto polishing.....	101
Preventing corrosion on battery posts.....	112
Oilcloth protects door upholstery.....	126
Step on truck endgate.....	128
Cleaning ball-bearing assemblies.....	128
Cover protects instrument panel.....	137

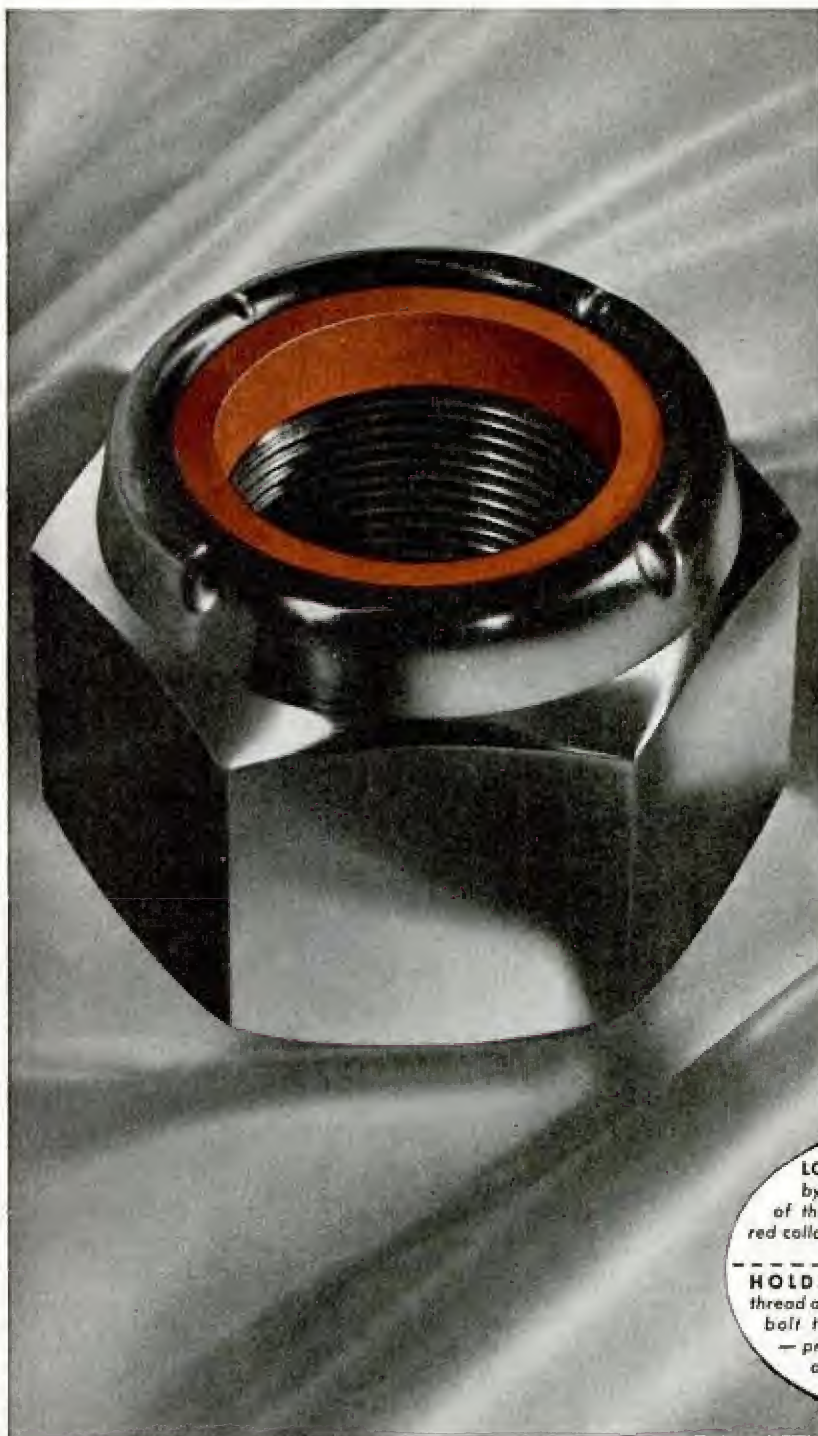
FARM

Can provides cover for tile vent.....	114
Truck endgate used as stock-loading ramp.....	118
Hog trough on wheels.....	128
Flashlight used to candle eggs.....	128
Adjustable swinging feed hoppers.....	136
Staples keep animal from unhooking door.....	136
Sandbag keeps lines from tangling.....	136

HAND TOOLS

Repairing worn slots in miter box.....	96
Removing broken shovel handle.....	96
Finger grip for short screwdriver.....	104

(Continued to page 6A)



WHAT'S A NUT FOR?

● A nut is for just one purpose. That is to fasten things together.

A good nut holds tight. It doesn't shake loose even under vibration.

This is the particular virtue of the Elastic Stop Nut.

This nut has an elastic red collar in the top. The collar grips the bolt and keeps the nut and bolt threads pressing tight against each other. There's no play. There's no wobble.

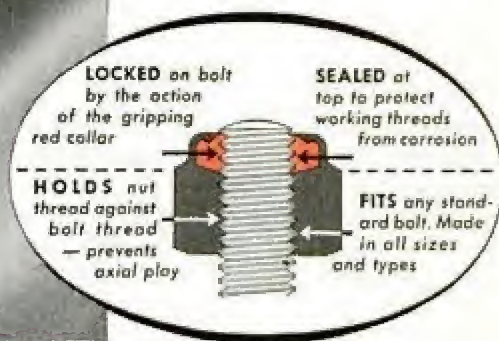

So the nut stays put.

It can be taken off and put back on and still lock. Anywhere on the bolt.

We've made billions of Elastic Stop Nuts.

They're on every airplane made in America. And on all kinds of war material.

And as far as we know, not one has ever failed to do its job surer and better than any other similar fastening.

Elastic Stop Nuts hold tight and make better electrical contact. Connections are safer and more efficient.



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ELASTIC STOP NUTS

Lock fast to make things last



ELASTIC STOP NUT CORPORATION OF AMERICA
UNION, NEW JERSEY AND LINCOLN, NEBRASKA

This One



W86B-9F3-K5WG



(Continued from page 4A)

Furniture glides improve bench vise.....	104
Pistol-type handle for hacksaw blade.....	127
Shaping screwdriver blades.....	136

HOME IMPROVEMENTS

How to frame a door.....	98
Downspout screen near ground easier to clean.....	112
Spike holds stud while toenailing.....	118

HOUSEHOLD

Nontip base for nail polish.....	92
Beeswax kept in match book.....	92
Solving home problems.....	94
"Birdhouse" holds clothespins.....	102
Deflector directs breeze in window.....	102
Nonslip treads for concrete steps.....	104
Rug-weaving needle made from bottle opener.....	110
Removing ice-cream-carton cover.....	114
Concealed brackets for wall shelves.....	114
Preventing breaks in lampcord insulation.....	114
Portable shoe rack.....	117

LAWN AND GARDEN

Removing ruts from lawn.....	92
Seed rows spaced with sled.....	96
Winter vegetable storage.....	105
Spray nozzle from tin can.....	108
Homemade wheelbarrow.....	109
Transplanting trees in restricted areas.....	112
Colored pinwheels frighten away birds.....	117

OFFICE

Removing creases in carbon paper.....	112
Envelope and card typed at same time.....	118

PHOTOGRAPHY

Accurate print timer.....	120
Belt steadies camera while hiking.....	123
Brush negatives in front of fan.....	123
Movies on ceiling for bedridden people.....	124
Mailing tube as enlarger bellows.....	124
Tightening ball clamp on reflector.....	124
Midget tripod made of wood.....	124

POWER TOOLS

Auxiliary saw table increases capacity.....	125
Cotter pins hold bandsaw blade for brazing.....	129
Milling attachment for lathe.....	137

RADIO AND ELECTRICITY

Auto set suggestions.....	141
General purpose pre-amplifier.....	142
Civilian War Emergency Radio Service.....	144

STORE AND SHOP

Hinged counter for store front.....	129
Rod in dustpan catches small parts.....	136
Preventing loss of worker's badge.....	140

TOYS, GAMES AND NOVELTIES

Rope ring for indoor marbles.....	92
All-wood toy fire truck.....	97
Child's play tent has no pole.....	114
Sword-ring game.....	119

WOODWORKING

Bead-forming tool.....	91
Carving a pheasant.....	93
Boring deep holes.....	138

MISCELLANEOUS

Shipmodeling in a bottle.....	89
Pocket for carrying baseball.....	102
Photographing notary seal.....	102
Shoe polish aids in scribbling lines.....	102
Tuning and repairing harmonicas.....	103
Safety valves from grease fittings.....	104
Novel pictures are reverse silhouettes.....	110
Make your own beach sandals.....	111
Rubber steering fulcrum for child's wagon.....	112
Glass wool filters acids.....	112
Replacing cane webbing in chair.....	113
Make your own pelorus.....	115
Safety pin holds pencil in pocket.....	118
Fishhooks carried in match book.....	118
Hot brick keeps roofing tar warm.....	137
Boots keep ladder from slipping.....	138
Gages and gage blocks.....	139
Probes made of wire.....	139

IMPORTANT NOTICE

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Business Demands Accountants



... because Accountants Command Business

Accountants are usually in demand—at better than average earnings.

But today—more than ever before—the competent accountant finds his services at a premium.

Business in war has tightened up the reins and is watching costs—prices—every move—striving to operate on that basis of close control so essential to service and profits.

Then, too, business is working under tighter government regulations, with many more records and reports—war production, priorities, more and larger taxes, wage and hour laws, payroll deductions for Defense Bonds, etc., etc.

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Whether their goal was a C. P. A. certificate or advancement in business, our files are full of letters reporting income increases far out of line with the time and cost investment.

Note for instance, these six cases out of many we might cite. (Names on request.)

A cost clerk, J. S. H. became, after completing 30 training assignments, cost accountant. Within nine months, only half through the course, he became chief cost accountant with a salary nearly four times what it was when he enrolled. C. K. was an immigrant day laborer. Within a few months he secured a bookkeeping job. Within a year, he secured three raises. In two years, he was in charge of his company's accounting department, although not yet through the training. W. J. F. moved up from store clerk to assistant bookkeeper after the first ten lessons. Now he is office man-

ager. S. W. N. knew nothing about bookkeeping. With 19 months of training he passed the C. P. A. examination on first attempt and opened his own public accounting office. Although a university graduate, P. M. was a grocery clerk at small wages. Today he is Secretary and Credit Manager with an income 300 per cent higher. Already in cost work, G. N. P. within nine months was earning 40% more; within two years, 100% more. The third year his income went up still more. Now he is manager.

These Men Won Success in Ordinary Times —You Have War Opportunities

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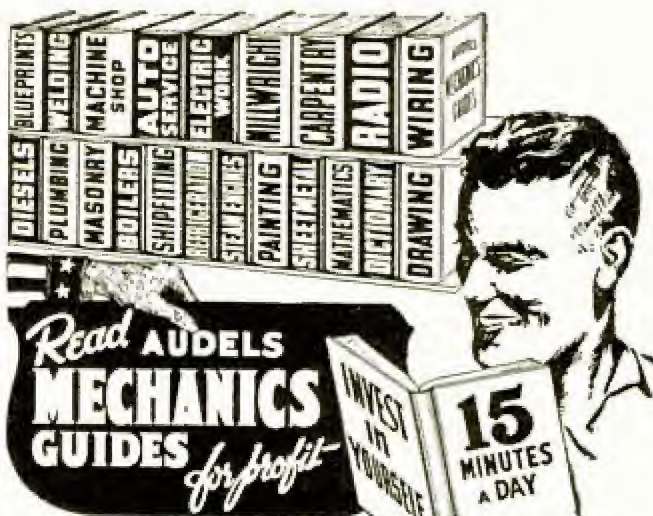
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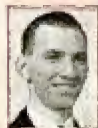
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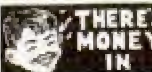
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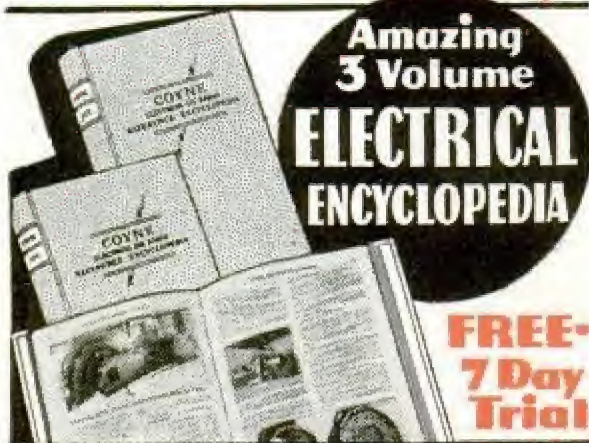
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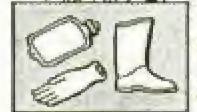
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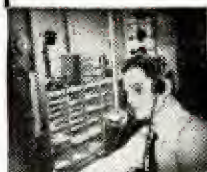
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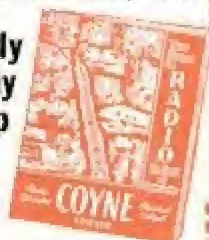
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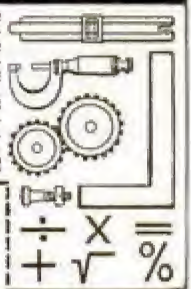
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
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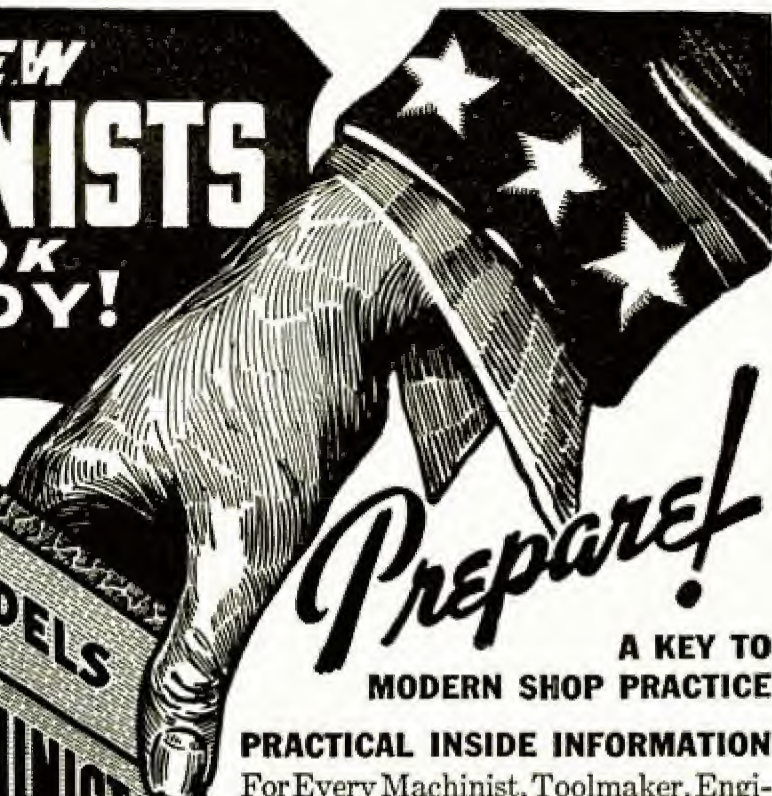
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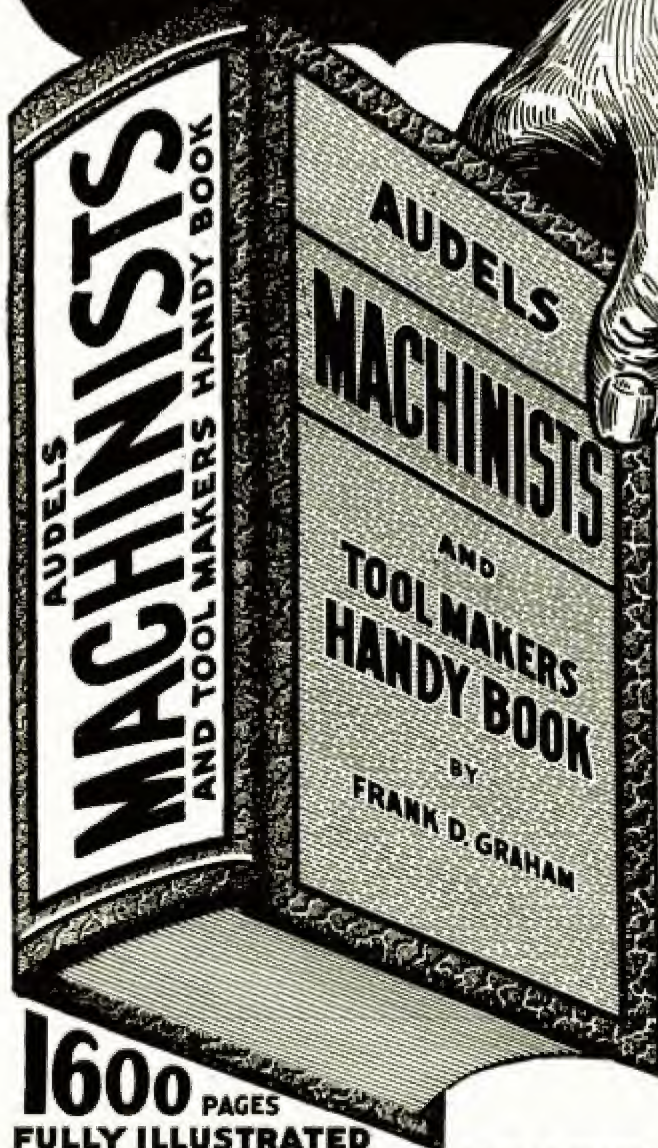
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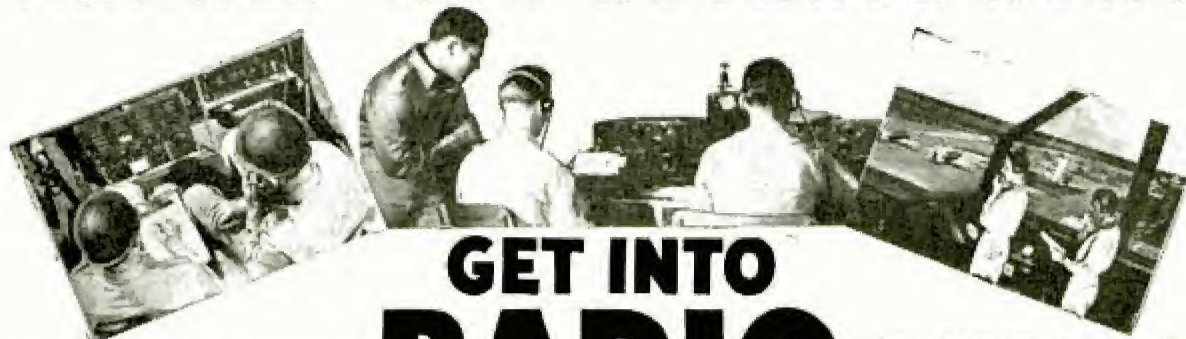
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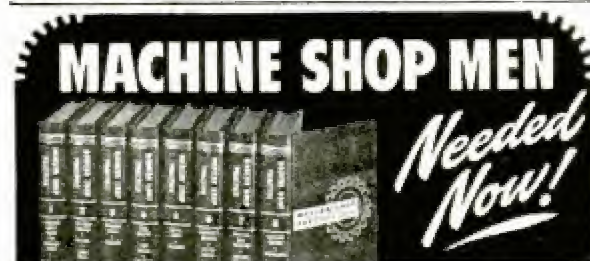
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AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

PROFIT 200-300%. Artistic cards. Christmas. Everyday. Wholesale. Samples 15c. Associated, Dakota, Bethlehem, Penna.

CHRISTMAS Cards. Make \$5.00 for each ten \$1.00 assortments you sell. Free samples outstanding 50 for \$1.00 name imprinted cards. Unusual demand. Write Howard P. Ellis, Dept. P.M., Pitman, N. J.

SHORTAGE Of new spark plugs! Dealers buying millions of rebuilt plugs. Known brands, neatly finished and packaged. 10,000 mile guarantee. Want distributor this territory. Standard Parts, 3033 Main, Kansas City, Mo.

SELL Art calendars featuring gorgeous artists' models photographed in nude colors. Biggest commissions. 6 assorted samples \$1.00. 15 assorted, \$2.00. Money-back guarantee. Ray Rogers, 603 Arbutus Building, Brooklyn, New York.

POWERFUL Mile stretcher! Increases mileage-power. 400% profit. Guaranteed. Thermox, Peoria, Ill.

HAND-PAINTED Wall plaques, 12 different samples \$1.00. 100 assorted \$8.00. Oman 642 Broadway, St. Paul, Minn.

BIRTHDAY. Everyday and Christmas cards for agents, stores and organizations. 4154g Fifth Street, Philadelphia.

SELLS Itself—New, 101% different, patriotic, fast seller. You sitting pretty quick, with over 100% profit. A protecting guarantee. Liberal samples postpaid 25c. Specialties, Box 931, Bristol, Virginia.

HIGH-GRADE SALESMEN

EXTRA Christmas profits—Send for free copy! 1943 wholesale catalog, featuring imprint lines, box assortments, clendars, pictures, greeting cards. Substantial profits! Elko, 438 North Wells, Chicago.

ADVERTISING Book matches. America's largest manufacturer of union label book matches. Fast selling line. Large sales producing kit. Sample matches. Complete cut catalog. 17 color combinations makes selling easy. Commission in advance. Superior Match Company, 7530 Greenwood, Dept. M-9, Chicago.

SELL Victory, service, MacArthur, Roosevelt, American flag, silk banners, blue stock signs to stores. Lowy, 8 West Broadway, New York.

SALESMEN—Big commissions. Leads furnished. Every business prospect, wonderful sideline. Sell pencils, Crescent, 152 E. 23rd Street, New York.

SALESMEN: Have real money making opening. Fits into war program. Old progressive firm. Dept. "F," Box 392, Dallas, Texas.

ADVERTISING Book matches—World's largest "direct selling" book match factory offers advance cash earnings calling on every type of business. Men or women. Experience unnecessary. Full, part time. Low prices. High quality. Quick deliveries. Powerful patriotic display. Special designs for army camps and naval stations. Repeats. Free kit, instructions. Match Corp. of America, 3433 West 48th Pl., Dept. E-9, Chicago, 32.

WE furnish capital and train you if you have at least 8 hours weekly to build profitable business of your own. No experience or investment required. Winona Monument Company, Winona, Minn.

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NEW Writers wanted to re-write ideas in papers, magazines, books. Splendid opportunity to "break into" profitable writing field. Rush postcard for free details. Comfort Writer's Service, 210-P South Seventh (2), St. Louis, Mo.

NON-RESIDENT, High school, college, professional courses. Bulletin free. Capital City College, Washington-5, D. C.

EXCEPTIONAL Opportunity. Operate a collection agency-credit bureau. Quickly learned. Many make \$5,000 yearly, up. Write Cole Associates, Syracuse, N. Y.

WELDING—Electric arc. Learn profitable trade quickly through actual practice. Individual welder instruction at bare cost of materials. Full particulars free. Valuable welding lessons book 50c. Hobart Welding School, Box M-932, Troy, Ohio.

REFRIGERATION Extension course. Booklet free. Training Department, 4701 West Pico, Los Angeles.

BE A doctor. Learn chiropractic. Fast growing profession. Residence course only. Write for catalog. Texas Chiropractic College, San Pedro Park, San Antonio, Texas.

SHORTHAND In ten lessons. Sample. Kee-Way System, Syracuse, N. Y.

BECOME A Doctor of Psychology (Ph. D.). Teach secret of contentment, happiness. Solve mental worries. Free book. College of Universal Truth, 5651-B North Ashland, Chicago.

YEAR'S Membership in Association of American Writers costs \$3.00. Includes year's subscription to "Arrival" writers, swappers, hobbyists, opportunity seekers magazine. (25c copy; add 3c word). Beautiful certificate for framing, automobile press sticker, official press card, constructive criticism. Cash in on your writing with new methods. Interview prominent people. Get passes to shows, fairs, etc. Join now. Melvin C. Churchill, Director, 319 So. Marengo, Pasadena 5, Calif.

DANCING Made easy! Diagrammed home study ballroom course, postpaid, only \$3. Ludwig's, 632 Geary, San Francisco.

DETECTIVE Training. Phillips Secret Service, 1917-B North Kenneth, Chicago, Illinois.

FREE Information. Amazing new, easy way to success. Psychologist, 675 Elliot, Denver (4), Colorado.

FREE List, world's best technical books for home training. Metro, 711-P So. Dearborn, Chicago.

LEARN Armature winding at home. Make big money! Investigate. Frazee, P.O. Box 5090, Zone 1, San Francisco, Calif.

MEDICAL Laboratory technicians in great demand. We train you in your spare time, in your own home. You can practice while studying. Write for free catalogue. Imperial Technical Institute, Box 973-E, Austin, Texas.

AUTO-OWNERS Guide Your Car describes hundreds of simple repairs, shortcuts, ways to get most out of gas and tires. \$1.25. Popular Mechanics Press, (C-43), 200 E. Ontario, Chicago.

SECRET Investigation. Experience unnecessary. Detective particulars free. George Wagner, M-125 West 86th, New York.

RADIO Engineering, broadcasting, servicing electronics, aviation, marine and police radio taught thoroughly. All expenses low. Co-educational. Catalog free. Dodge Institute, Dept. R, Valparaiso, Ind.

GOOD "Used" educational books on all subjects bought, sold, rented, exchanged. Satisfaction guaranteed. Complete details and 84-page illustrated bargain catalog free. Write Nelson Company, 321 South Wabash, Dept. 208, Chicago.

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DRUNKENNESS Is a disease which responds to treatment. Medical skill plus human sympathy prove successful with liquor and drug cases. 60 years experience. Write for free booklet. P. M. Nelson, The Keeley Institute, Dwight, Ill.

LOCKSMITH Course. Lock picking, key fitting, etc. \$1.00 prepaid. Locksmith, Canadian, Texas.

SHORTHAND—World's first scientific analysis. Basic guide to all education, invention, designing, efficiency, \$1.00. Instantaneous memory system. Representatives wanted. Light System, Hyde Park Bank Bldg., Chicago.

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CARTOONING, Drawing courses. Practical— inexpensive. John Warren, N7509 Smith, Spokane, Wash.

MAKE Money by cartoons! We'll show you. Hartman, 2438 W. Lincoln, Nebr.

CARTOONING Course—30 illustrated lessons, over 500 sketches. \$1.00 postpaid. Montes Studio, Box 892, Pasadena, Calif.

TRICKS Chalk stunts. Catalog 10c. Balda The Cartoonist, Oshkosh, Wisconsin.

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LETTERHEAD Specialists, exclusive artist designing. Gill, Box 675, Huntsville, Alabama.

DOLLAR-GETTING Letters, powerful direct mail advertising planned, written. Details, stamp. Bradley, 3839 Morse, Chicago 45, Ill.

ADVERTISE Profitably: \$15 reaches 5,000,000 Sunday newspaper readers with 24-word ad. Newspaper, magazine, mailing-list ratebook, free. Chicago Advertising Agency, 20-PA West Jackson, Chicago.

ADVERTISING Placed, any publication, lowest rates, complete agency service. Skilled advertising—merchandising counsel. Ratelist and booklet, entitled "Advertising Results For Sale" free. Baker Agency, 3302 Dodge, Omaha, Nebraska.

ADVERTISE—Newspapers, magazines. Publishers' rates. Martin Agency, 171R Madison Avenue, New York.

COMMERCIAL Art, advertising illustrations, any purpose. Trade-mark, letterhead or label designing. Reasonable prices. Baker Studios, 3302 Dodge, Omaha, Nebraska.

24 WORDS, 35 Newspapers \$2.00. Goodall, 37 Gardner, Vallejo, California.

FREE—New Advertisers Rate Guide. 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency. Merchandise Mart, Chicago.

FREE—"Amazing New Book"—"Profits From Classified Advertising." Tells how and what to advertise. Be sure to read this book before you invest one cent in advertising. Remember—it's free! Write for your copy now. F. W. Johnson, Classified Advertising Manager, 200 East Ontario Street, Chicago, Illinois.

ADVERTISE: 24 Words, 149 newspapers, \$6.50. Lists free. Advertising Bureau, 4515-G Cottage Grove, Chicago.

ADVERTISING Placed all magazines, newspapers U.S.A., Canada. Lowest rates. Free service. 54-page catalog free. Baker Advertising Agency, A-189 W. Madison, Chicago.

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JACKSONVILLE, Fla., mail address \$2.00 monthly. Your mail received and forwarded daily. Empira Mail Service, Box 85, Jacksonville, Fla.

NEW York mailing address 50c per month. Details 10c. Acme, Box 494, Mount Vernon, N. Y.

WE Collect notes. Accounts everywhere. No charge unless collected. May's Collection Agency, Somerset, Ky.

HAWKINS Mail Service, Washington, D. C., receives, re forwards, business personal mail. \$2.00 monthly. No. 77 Randolph Place. (Letters, postcards mailed—10c, 3 for 25c coin.)

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TYPEWRITERS, Adder, mimeograph, multigraph, addressograph. Send for free lists of machines that will help you at half price. Pruitt, 28 Pruitt Bldg., Chicago.

RUBBER STAMPS, OFFICE SUPPLIES

ONE Line 15c, 2 lines 25c, 3 lines 35c. Excella Sales, Dept. B, Box 500, Shreveport, Louisiana.

3 LINES 30c; cushioned, indexed, 35c. Signatures \$1.50. Stamprite, Wauwatosa, Wis.

KNOB Handle, cushioned, 2 lines 30c, 3—40c. Stamp Works, Centerport, N. Y.

SUPERIOR, Three lines 35c, four 50c. Clothing markers. \$1.00. Slocum, 814 Bradley, Peoria, Ill.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, GUMMED LABELS

DISTINCTIVE Printing—Business forms, letterheads, stationery, folders, etc. Get our quotation on your printing. Free copy service, counsel, samples. United Enterprises, Dept. PM-2, Box 93, Downingtown, Penna.

MIMEOGRAPH 300 Letters or penny postcards \$1.00. Additional copies 10c per 100. No lineage limit. Dollar Letter Service, 180 W. Washington Street, Chicago.

125 LETTERHEADS And 125 envelopes, \$1.50 prepaid. Gago Print Shop, Box 1544, Muskogee, Oklahoma.

200 PLATELESS Embossed letterheads \$2.00 postpaid. Printing, multigraphing reasonable. Universal, 203 Avon Avenue, Newark, N. J.

100 8½x11 BOND Letterheads and 100 6½ envelopes \$1.00 postpaid. Mero Products, Box 344, Punxsutawney, Penna.

PRINTING, All kinds, best work. Try Edwards Press, 5217 Filbert, Philadelphia.

100 8½x11 BOND Letterheads and 100 envelopes \$1.00 postpaid. Benneville, 907 West Roosevelt, Philadelphia 40, Penna.

1000—6x9 CIRCULARS For \$1. Armand Cartier, 695A North, Pittsfield, Mass.

1,000 GOOD Business cards \$2.25; 2,000—\$3.70. Banjock, Freehold, Pennsylvania.

CENTRAL West Printers—Leading mail-order printers and mailers—3226-P Jackson, Chicago.

MIMEOGRAPHING—Letters, pricelists, formulas, instructions. Lowest prices. Lem's Letter Shop, 5710 Stanton, Detroit 8.

HAMMERMILL Bond stationery. Reasonable prices. Samples, Gooch, 202PM, Hernandez, Miss.

OFFSET Printing economically reproduces your present letterheads, letters, office forms, maps, music, envelopes. Modern Lithoprint, Jefferson City, Missouri.

NOTICE! Army, Navy, Marine, Coast Guard and professional stationery: 200 bond letterheads and 100 envelopes printed with your service insignia in royal blue \$1.75. 1000 business cards \$1.45. 1000 Franconia bond letterheads or envelopes \$3.00. Jack's Printing Service, Box 5450, Metropolitan Station, Los Angeles, Calif.

BETTER Grade printing reasonable. Estimates on anything. Economic Press, Leonia, N. J.

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WANTED Printing of all kinds by thousands of our readers. Your ad in this space will bring you some nice orders. Write for positive proof. P. W. Johnson, Classified Advertising Manager, Room 304, 200 East Ontario Street, Chicago.

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NEAT Printing—Multigraphed letters. Carefully planned and produced. Samples. Ace Printers, Brentwood, Md.

THOUSAND 6x9 Circulars: advertising cards, \$2.95. Samples. Reporter, Chelsea, Oklahoma.

500 4-LINE Stickers. 25c. Press, 749 S. Plymouth, Rochester 8, N. Y.

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INEXPENSIVE 6x9 Printing press. Details free. Novelty Shop, Downsville, Louisiana.

PRINTING Outfits and supplies. Send stamp for details or dime for complete illustrated supply book. Kelsey, Inc., W-11, Meriden, Conn.

USED Presses, type, supplies. Lists 3c. Turnbaugh Service, Loysville, Penna.

PATENT ATTORNEYS

INVENTORS—First things come first. Your first move toward securing a patent on your invention is acquiring full information on what to do. Our two books "Patent Protection" and "When and How to Sell Your Invention" contain this information and other helpful data. Get them immediately together with our "Evidence of Invention" form. They cost you nothing, you assume no obligation. Write now to Victor J. Evans & Co., Registered Patent Attorneys, 731-K Merlin Building, Washington, D. C.

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"INVENTOR'S Guide," 100 mechanical movements, free; advises on patenting, selling inventions. Frank W. Ledermann, 154 Nassau Street, New York.

PATENTS—Trade marks. Preliminary advice, book and disclosure form free. Personal service. Irving L. McCathryn, 315 McLachlen Bldg., Washington, D. C. Registered Patent Attorney.

L. F. RANDOLPH, 302-B Columbian Bldg., Washington, D. C. Low cost. Book and information free.

PATENTS Protect your idea by securing free "Proof of Invention" folder. Exceptional personal service. Established 1906. E. E. Vrooman, 871 Woodard Bldg., Washington, D. C.

SELL Your patent through a small classified ad in Popular Mechanics. Many inventors have found buyers in this way. Ask me for proof—I'll gladly send it to you. F. W. Johnson, Manager Classified Advertising, 200 E. Ontario St., Chicago.

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INVENTORS—Learn now—without obligation—how to protect and sell your invention. Secure free "Record of Invention" form for establishing date of your invention—and free book "Patent Guide for the Inventor" containing complete information about patent procedure and selling inventions. Delay may be costly. For prompt, confidential service—write to—Clarence A. O'Brien & Harvey Jacobson, Registered Patent Attorneys, 31A-J Adams Building, Washington, D. C.

INVENTORS—Information on what to do first toward securing a patent on your invention is of vital importance. "Patent Protection" and "When and How to Sell Your Invention"—two valuable, richly illustrated books—explain fully what to do first, and a lot more. Get this information quickly together with "Evidence of Invention" form. All three will be sent to you free. Write immediately to Victor J. Evans & Co., Registered Patent Attorneys, 732-K Merlin Building, Washington, D. C.

INVENTORS! Patented or unpatented we promote your invention. M. Humphries, #12 Otis Bldg., Philadelphia, Penna.

DIRECT Contacts with manufacturers. Free details. McConnell-Petermann, 16114 Burt, Detroit 19, Michigan.

CAN An inventor make money today? In 1941 alone over 4,000 assignments of patents a month were made by inventors to manufacturers or individuals. This shows today's demand for new patented inventions. Write for our free book, "Protect, Finance and Sell Your Invention." Special form "Invention Record" also mailed free. No obligation. McMorow & Berman, 134-X Albee Building, Washington, D. C.

I SELL Patents. Established in 1900. Charles A. Scott, 773PM Garson Ave., Rochester, N. Y.

COMPLETE Inventors service. Write P.O. Box 5701, Los Angeles (55), Calif.

INVENTORS: Manufacturers are buying patented or unpatented ideas. Write Invention Bureau, 2224 Sturdevant, Davenport, Iowa.

INVENTORS: New military and commercial inventions urgently needed by manufacturers. Write for particulars. Chartered Institute, Dept. 4-A, Washington, D. C.

CASH For practical ideas and inventions. Mr. Ball, AB-9441 Pleasant, Chicago.

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INVENTORS' Opportunity—Large Pacific coast manufacturer with iron, aluminum and magnesium, and permanent mold foundries, and large production machine shop (now 100% on war work) will consider, on royalty basis, mechanical inventions of volume sales possibilities for immediate or post-war sale and manufacture. National coverage. No engineering or tooling cost to you. Describe invention and uses in first letter. Development Department, The Kinney Company, 275 N. Ave., 19, Los Angeles, California.

INVENTORS! Have you good patentable ideas? Write Mr. Metzler, 11 West 42nd, New York.

INVENTIONS Bought, sold, financed, patented, unpatented, no advance charges. Invention Sales Company, Marshall Building, Cleveland, Ohio.

INVENTIONS Wanted with postwar possibilities. Write P.O. Box 5701, Los Angeles, Calif.

PATENTERS! Free booklet, "Selling Your Invention," tells all about right way to market your invention. Inventors Patent Exchange, 1133 Broadway, New York.

NEW Product ideas. A reputable manufacturer will consider new patentable items (preferably of metal) for manufacture and distribution in the aircraft, automotive, marine, industrial, or household field. Ideas will be purchased outright or on royalty if accepted. Write briefly the nature and intent of your idea and, if interesting, we will send complete instructions on how to submit full details for fair consideration. Address P.O. Box No. 6796, Philadelphia, Penna.

WANTED—New tools for automotive and aircraft work. Will buy patents or designs outright or as finished tools. Give details. Tools Division, Box 56, New Britain, Conn.

INVENTORS: Have you a sound, practical invention for sale, patented or unpatented? If so, write Chartered Institute of American Inventors, Dept. 4-D, Washington, D. C.

WANTED—Meritorious patented, unpatented inventions. Booklet, references, free. Invention Reporter, 5B-11236 So. Fairfield, Chicago.

CASH For inventions, patented, unpatented. Mr. Ball, A-9441 Pleasant, Chicago.

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POSTWAR Priming will pay us! Investigate. Plastic compounds dispenser delivers uniformly, continuously. T. Pasanen, Franklin Mine, Mich.

INEXPENSIVE Curtain, drape, shade bracket. Patent 2319715. Barndollar, 349 Twelfth St., Elyria, Ohio.

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MODEL Kits and supplies, catalog 10c. Steve Patti Co., 1443 W. Forest Home Ave., Milwaukee 4, Wisconsin.

SHIP Model kits and fittings. Complete line Fisher model yacht equipment. All Boucher, Fisher, Marine Model and Ideal kits, fittings and blueprints at standard prices. Most complete stock in New England. James Bliss & Co., Inc., 220 State Street, Boston, Massachusetts.

RAILWAY Models, complete line informative catalogs O gauge, 104 pages, 25c; HO, 48 pages 15c. Walthera, 247 Erie, Milwaukee, Wisconsin.

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WILL Sell set little used power tools, 2 motors. Morgan Clements, Demopolis, Alabama.

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OPALS. Sample packet \$5.00. Catalogue free. Norman Seward, Melbourne, Australia.

WATCHES. Parts, tools, jewelry, diamonds—bought, sold. Catalogue. Gales, Box 1000, Chicago.

HIGHEST Prices for old gold—Mail your teeth, watches, jewelry, 100% full cash value mailed day shipment received. Satisfaction guaranteed or articles cheerfully returned. Information free. Chicago Gold Smelting Company, 300-P Champlain Building, Chicago.

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CUT Your cigarette bill—Trial package mild, smooth, flavorful shredded cigarette tobacco with gummed papers, enough for fifty cigarettes, 20c. Pete Moberly, Box 968, Owensboro, Kentucky.

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PRISMS. Radium, anatomical charts, Science—Culture, 3915 24th Street, San Francisco.

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FALLING Hair, its cause and prevention, is fully explained in an informative, and educational pamphlet entitled "How to Keep Your Hair Till Ninety." For free copy write, James Hilton, 4819 Fourth Ave., Brooklyn, N. Y.

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LIVE Longer. Feel better. Free chart. Fairchild Company, Mt. Vernon, Ohio.

LIBRARY Of 1700 time and labor saving ideas for everyone who uses tools. Shop Notes for 1940, '41, '42, '43 \$1.95 per set. Popular Mechanics Press, (C-43), 200 E. Ontario, Chicago.

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MAKE Your own printing cuts, "Plasto" method, simple, practical. No messy chemicals. Adayservice, Argyle, Wisconsin.

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RECEIVE Mails, magazines, samples. Your name in numerous mailing lists 10c. Howard, 396 Broadway, New York.

FALL-WINTER Garden profits. Manchua Chinese cabbage—matures eight weeks. 300 seed 25c. Gardens, 126 N. Main, Tulsa, Okla.

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EXPERT Alarmclock repair. Free estimates. Brooks, 2106 S. State, Chicago.

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UNPAINTED Wall plaques, 30 different samples \$1.00. 100 assorted \$3.00. Oman, 449 Broadway, St. Paul, Minn.

FEATHERLIKE. Closer shaving. Attachment fits 2-edge safety 25c. Agents 10c. Adjustrite, 35 P.M. North 9th, Columbus, Ohio.

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NEWS Writers and photographers please write 1934-R Eleventh, Washington, D. C.

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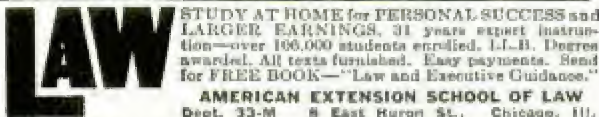
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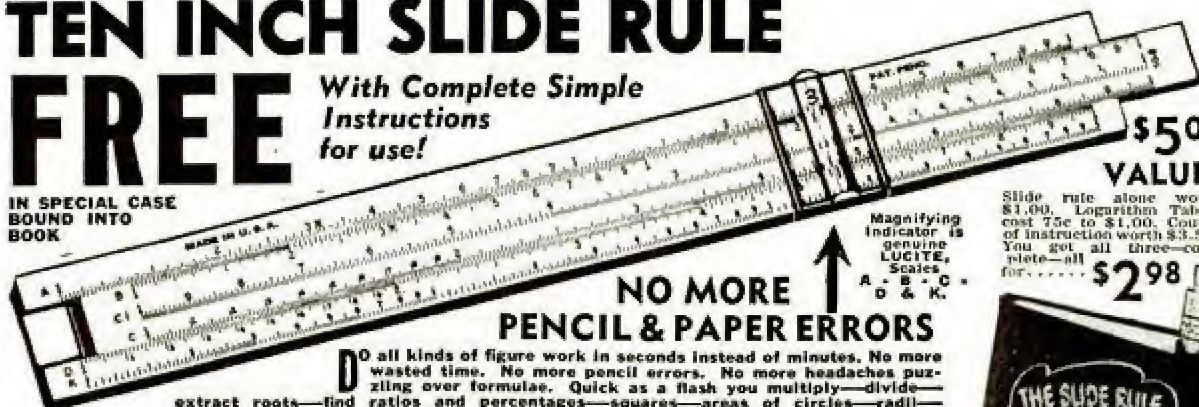
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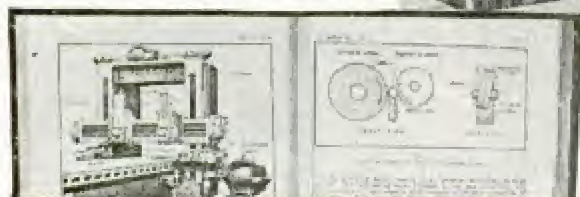
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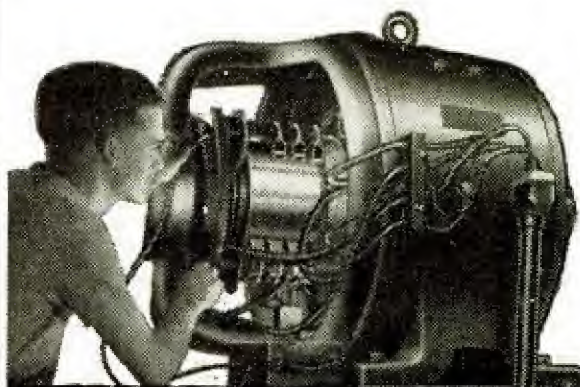
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N 449
Vol. 80

SEPTEMBER, 1943

No. 3

ALEUTIAN SPRINGBOARD



Light tanks rumble across the frozen tundra as U. S. troops advance along chain of fog-bound Arctic islands

AFTER long icy months of sharpening its claws on the barren rocks of the Aleutian Islands, the American eagle suddenly pounced on its monkey-like foe. Military secrecy, as thick as the pea-soup fog that usually shrouds the 1,000-mile chain of islands stretching from Alaska toward Tokyo, was lifted. The world got an eyeful and Tojo got a million high explosive and incendiary bombs down his back in a single month.

Things began to pop so suddenly—on Amchitka, Adak, Attu, Kiska—that a lot of people received the impression they just happened over night.

But that claw-sharpening process, that inching westward from Dutch Harbor against almost impossible hardships will be recorded as one of the epic struggles of mil-

itary history on land, at sea, and in the air.

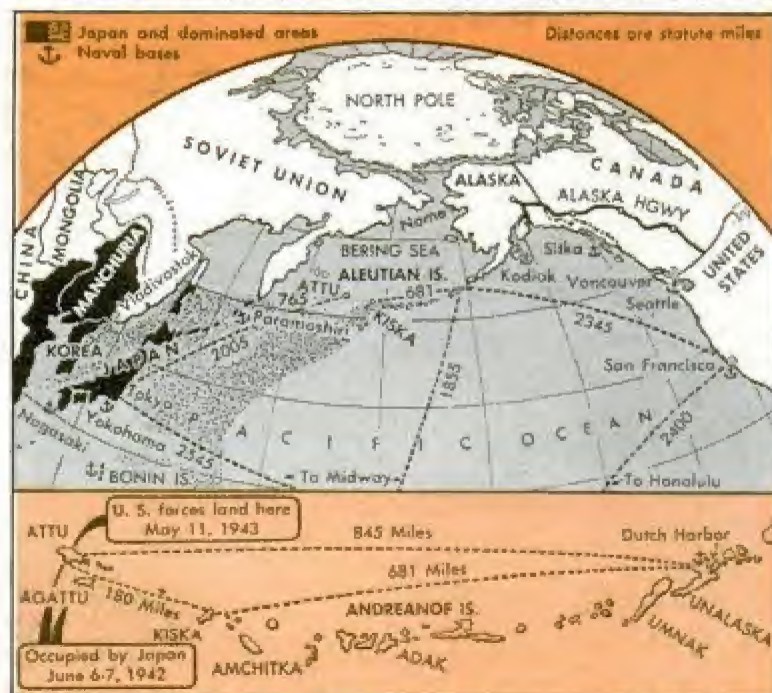
It's a story of bold Navy and Army pilots who pressed on after the Japs through fog and storm when gasoline gauges showed they had barely enough fuel to get back to base. Of Seabees laboring in sub-Arctic blizzards to chip a toehold in the brittle rock. Of ground crews working round the clock to fasten torpedo racks under the wings of PBV flying boats. Of combat scouts who reconnoitered in snow up to their armpits or sloshed through mud to their knees, often just one jump ahead of the Japs. Of drenched troops who dashed through icy waters in January to occupy Amchitka under the Japs' very noses. And of naval units that pushed onward through seas so wild that destroyers shipped water down their stacks.

SEPTEMBER, 1943

*Off: War Dept.
Bureau of Public Relations
Washington, D. C.*



This mobile 37-mm. gun spells death for Japs holding out in icy foxholes



Courtesy of the New York Times

This map shows the strategic location of the Aleutians with Attu just 765 miles from big Jap naval base at Paramoshiri, 2,005 miles from Tokyo

Working as a single hard-hitting machine, the Navy and Army forces conspired to hand Tojo his most unpleasant surprises since Midway. Our Aleutian fighters have had to battle not one, but two treacherous enemies—the weather and the Japs. They all agree the weather is far the tougher foe. The pilots, who ought to know, call it the worst in the world.

"We've got landing strips where the wind blows from one side, east on the other—and that's no joke," said one pilot.

"The rain here comes down sideways," observed a bombardier. "It begins to fall over Siberia, but it lands on us at 60 miles an hour."

But the rain and the williwaws, those

sudden gusts of cold air that whip over the frozen tundra and change in a twinkling from breeze to hurricane, are minor annoyances compared with the thick blankets of fog that hide volcanic peaks and offshore reefs. The fog makes navigation in the air or on the sea a nightmare.

Half of the time the pilots don't bother to wear parachutes because they fly so low they wouldn't open anyway. Besides, in the bitter cold Aleutian waters a man can only live 20 or 30 minutes.

The foul weather, of course, plays no favorites, but since the attack on Dutch Harbor in June, 1942, the Japs have been on the defensive and we the offensive. Any arm-chair strategist will tell you that bad weather is more favorable for defensive than offensive action.

Lt. Gen. Simon Bolivar Buckner, Jr., chief of the Alaska command, insisted on an offensive position from the start.

"If you've got to kill a rattlesnake," he says, "you don't wait for him to strike—you smash his head."

Gen. Buckner was largely responsible for the Japs' first big surprise in the Aleutians. Right after the attack on Pearl Harbor he predicted the Japs would strike at

Alaska through these islands. He described this area as a neglected military stepchild.

There was a time in the early days of the war when men in high places viewed the Aleutians through the eyes of old-fashioned mapmakers. They were the same men who for years had ignored the Japanese fishermen swarming about the tiny volcanic islands, making maps, taking soundings and studying the weather.

The Japs knew more about the Aleutians than we did when war broke out. They had no illusions about the strategic value of the islands which lie in the direct circle route from Tokyo to our mainland. The heart of Japan is only about 2,000 miles from Kiska and the big Jap naval base

of Paramoshiri on the northern tip of the Kurile Islands is some 765 miles from Attu—an easy stride for a long range bomber.

Tojo, too, was aware of possible Russian reactions in regard to the Aleutians. If the U. S. held this frosty trump card, Tojo probably feared the Russians might be inclined to get tough, might even consider an Allied air base in Siberia. Now if Japan held the Aleutians, well—it was worth a try. And every healthy Jap liked to dream about bombing Los Angeles and Chicago from a base in Alaska.

Gen. Buckner's agitation resulted in the formation of the "Blair Packing Company." To Japanese spies this was just another salmon packing outfit being set up by the unsuspecting Americans on Umnak Island just west of Dutch Harbor. But the only fish the Blair Company was interested in were tin ones, shaped like torpedoes.

Ships carrying heavy crates labeled "Blair Packing Co." were unloaded at Umnak. Instead of holding cannery machinery the crates were bulging with all sorts of military supplies. The ruse worked, and a secret base bristling with antiaircraft guns and crossed with runways for fighter planes was established. Until then our only air protection was PBY flying boats which were designed for leisurely patrol and not combat.



Army and Navy expeditionary force landing on Amchitka, 62 miles east of Kiska, after hazardous trip through storm that kept Jap planes grounded



Framed beneath wing of Navy PBY, a P-40 fighter prepares to take off from Amchitka. Below, small boats bring troops ashore





Knee deep in Amchitka mud, soldiers joke over baseball gear

The "Blair Packing Company" is credited with saving Dutch Harbor and probably Alaska. When the Jap invasion fleet arrived in force, with at least two aircraft carriers, several destroyers, cruisers and troop ships, the Nips had every reason to believe their attack would be a success. But when the Jap planes came roaring in over Dutch Harbor they found themselves suddenly attacked by U. S. P-40 fighters a thousand miles from where any land based planes were supposed to be.

The surprised Japs lost about 40 planes in their first attack. The invasion fleet, itself, at one time only a hundred miles from

Dutch Harbor, would have been blown out of the sea except for the weather. PBY patrol planes would contact the fleet from time to time, but due to the fog it was impossible to maintain the contact long enough to summon bombers. Some bombs from roving planes struck near enough, however, to scare the Japs off. They backed up nearly 700 miles west to Kiska.

The Jap fleet had submarines along, too. One day when Lt. W. N. Theis was out patrolling in his PBY, he was surprised to see a Jap sub surface below him. He dived on the sub and the bomb fastened to a rack beneath his ship obligingly released itself. The bomb, fused for impact with a solid object, exploded—good evidence of a hit. A few weeks later another PBY scored direct hits on a sub which was then sunk by gunfire from a destroyer. Earlier, the sub had torpedoed a tender used for refueling flying boats.

When the Jap expeditionary force was discovered on Kiska and Attu, the PBY pilots set forth on one of the most amazing aeronautical feats of the war. They dubbed their outfit the "Kiska Shuttle Service" or the "PBY Interceptor Command." Every available plane was pressed into service and the crews, both air and ground, worked night and day. One young pilot flew 19½ hours out of 24. The men flew through fog and darkness. Torpedo racks were attached under the wings of the big amphib-

Something finally stopped a jeep—spring thaw in the Aleutians. Here one is being towed out of muck



ians. They bombed everything in sight on Kiska and in the harbor there, and all ships encountered along the way.

The pilots made their daring attacks by diving through the overcast at the unheard of speed (for the flying boats) of nearly 300 miles an hour. The big ships would plunge through the fog into the clear over the Japs, the bombs would fall away, and it would take both pilots to pull the plane out of the dive. The ships' wings would flap like a seagull's under the tremendous strain of doing a job for which they were never intended. Nobody knows how they managed to hang together.

During the first days of bombing Kiska, some reinforcements arrived from bases on the western U. S. coast. Many proceeded directly to the attack without removing personal baggage after the long ferry flights. One PBVY squadron was over Kiska four days after leaving the

(Continued to page 156)



Keith Wheeler, foreign correspondent, gets an interview from the owner of only washing machine on Amchitka. Tent covers a shallow dugout



Left, Navy pilot returning from routine patrol flight walks through blizzard toward his tent. U. S. airmen say weather is world's worst

Hardy infantry unit (below) fires a practice shot. When they landed on Attu, groups like this one had to flush stubborn Japs from foxholes



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Arctic Winds Run Washer for Men in Aleutians



*Capt. Earl Fuch
St. Paul, Minnesota*

Correspondents in the Aleutians battle area off Alaska write home about the heavy winds prevailing there, but it took an inventive soldier to put these arctic gales to work. He devised a windmill washing machine, out of a fuel drum and boards from packing cases, with a chain and sprocket to deliver power to wooden paddlewheels in a wash bucket. When the wind turns the windmill, the paddlewheels beat his clothing clean. His invention retained its popularity until electricity was supplied the encampment.

No blue Mondays in Aleutians when wind is the laundryman

U.S. Army, Public Relations, Washington, D.C.

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Rough on enemy armor is this gun, propelled at speed of a medium tank

Sentry Box Mounted on Truck Chassis Gives Guard Wider Range



Guards are rushed to any danger area with a portable sentry box mounted on a Dodge chassis. The regulation box is erected on a platform completely surrounded by a safety railing and has screened windows on all sides, providing excellent visibility. The soldier on duty during bad weather is afforded shelter and at the same time can keep a sharp lookout. The mobile sentry box was developed by the automotive department at Newark Army Air Base.

Safety railing surrounds the sentry box, which can be rushed to any danger area

6 *Capt. Arthur J. Lerman, Air Corps
Public Relations Officer
Newark Airport, Newark, N. J.*

Russian Rocket Guns Hurl a Barrage of Shells

Rocket throwers, one of the most secret of Russian war weapons, are fired by remote control. These weapons, which hurl a steady stream of self-propelled shells, played an important part in the defense of Stalingrad. Mounts for rocket guns are lightweight because there is little recoil in fir-



Operated by remote control and with lightweight mounts that can be moved easily, Russian rocket guns fire stream of shells

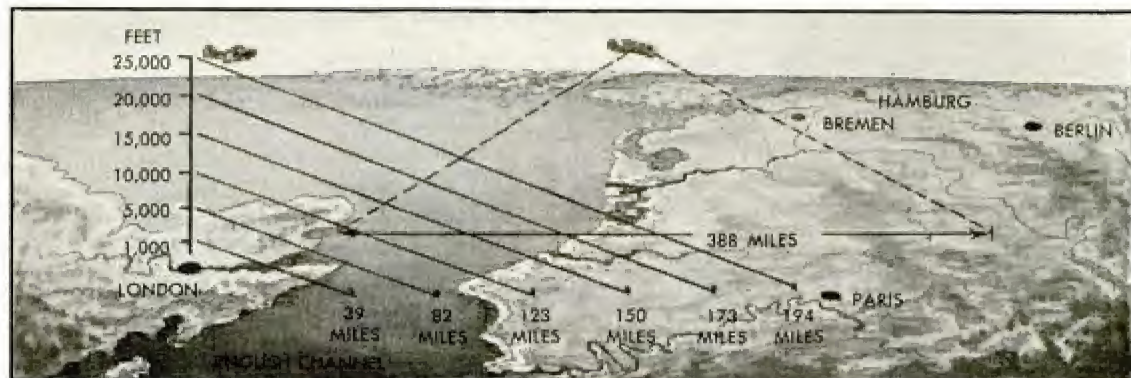


ing and they can be moved about easily. Several types of rocket throwers have been developed by the Russians, including one that consists of little more than a rail under the wings of Stormovik fighter-bombers. The rockets are aimed by diving the bombers. The British and Germans also have rocket guns in service, details of which are closely guarded.

Earth Curve Table Shows How Far Airplane Pilots Can See

Pilots of a Flying Fortress cruising at 25,000 feet can see right into Germany before they are out of sight of England's Channel coast, according to a formula worked out by Pan American Clipper captains. By elevating yourself, you can look right over the curvature of the earth. Actual curvature of the earth for the first mile is about 9 inches, and the dip increases thereafter at a rate approximately equal to the square of the distance in feet. By multiplying the square of the distance in miles by .67, you can find how much the earth

has curved under at the distant point. For instance, the surface of the earth 10 miles from where you stand is 67 feet lower than you are. On the sea's surface, at eye level, you can see only 2.9 miles. On land, this varies with your altitude and the altitude of the object you are looking at. The Clipper captains' formula shows the range of vision is equal to the square root of the altitude multiplied by 1.225 miles. Thus, given clear skies, you can see 122.5 miles from 10,000 feet, 150 miles from 15,000 feet and 194 miles from 25,000 feet.



Given clear skies, the chart above shows the distance in miles that a pilot can see at varying altitudes

Mr. Thomas G. Munson, Jr.
3872 Franklin Ave., Los Angeles, Calif.

71 238



LIFE ON A RAFT

Cadets on life raft flash mirror to signal rescue plane. Left, special gear includes whistle, red flashlight and knife



ing kits are standard equipment on lifeboats and rafts.

In times of peace a lifeboat simply kept you afloat until a rescue ship reached you, a matter of hours or a couple of days at most. It was an adventure to talk about afterward with few hardships attached to it. But under war conditions rescue is not always certain. Survivors on a raft may drift around for weeks before they are found. Those on a lifeboat may have to rescue themselves, sailing hundreds or thousands of miles to safety.

Already dozens of stories have been told of the heroism of men who have lived through the hardship and torture of weeks in cramped boats. They shiver with cold and exhaustion at night, bake under the sun during the long daylight hours. Rations diminish and they limit themselves to a mouthful of food and a swallow of water per day. Captain Bligh's famous feat of sailing thousands of miles in a small lifeboat 150 years ago has been duplicated or bettered several times recently. Modern seamen have the same stamina and tenacity that their forefathers had.

WOODEN pegs to plug bullet holes.

A mirror for signaling airplanes.

Hooks and lines to catch fish.

These are some of the things that seamen who have had to spend weeks in lifeboats would have given an eye to possess. Their suggestions have been adopted and now wooden pegs, signal mirrors, and fish-

Captain Eddie Rickenbacker and his men could have been rescued a few hours after their plane was forced down if there had been a radio transmitter on one of their rubber life rafts. In fact, a radio for just that purpose was being designed and built while Rickenbacker was drifting around. The compact transmitter sends out an automatic SOS signal and its antenna may be raised by box kite or hydrogen balloon. A rescue plane uses its own directional loop to guide it to the spot.

But few lifeboats of surface ships are equipped with radio. The cruel common sense of war has decided that it is better for a handful of survivors to take their chances with the sea than to attract other ships to the spot, possibly causing more sinkings and greater loss of life. Instead, lifeboats and rafts are equipped with gear with which to attract the attention of ships or planes that happen into the vicinity. The equipment includes bright orange distress flags, smoke pots that set up clouds of orange smoke, large polished metal mirrors to attract attention by their flashes, and pistols for firing rockets after dark.

All sorts of emergency equipment not used before are being placed in lifeboats these days. You need ointment for cleansing fuel oil from the eyes of men who have swum through the stuff, you need whistles and lights that men can attach to their life jackets so that they can be found after dark. You need safety matches in a waterproof container for warmth and cooking if you happen to land on a desert island or uninhabited stretch of coast. All of these things have been suggested by men who suffered from the lack of them. The whistle and lamp are attached to a life-jacket by a stout cord that also carries a heavy clasp knife. The lamp consists of



Merchant marine cadet, his face smeared with fuel oil from the wreck, steering lifeboat. Below, applying ointment to eyes of rescued sailor



Seaman (below) firing distress rocket from lifeboat after dark in effort to attract ships or planes. Its glare can be seen for miles



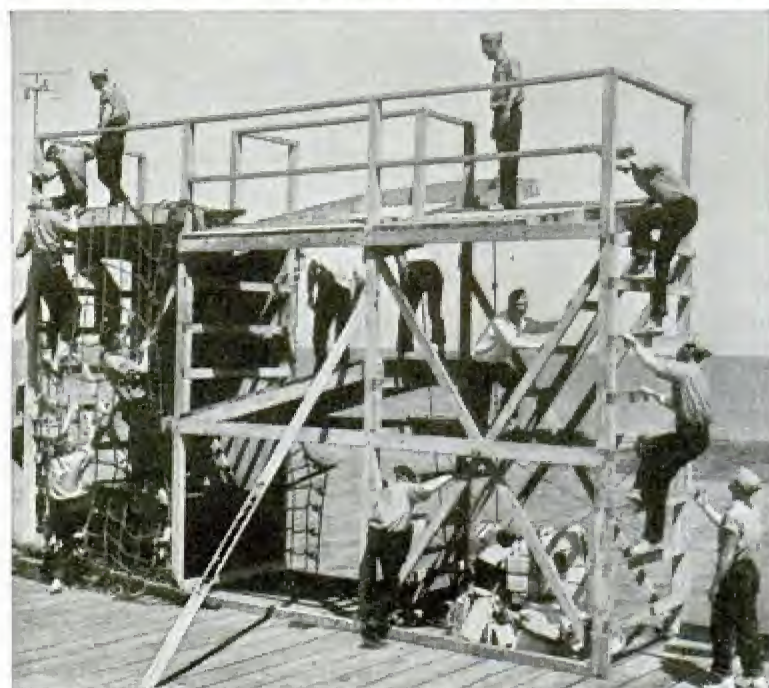


Off for all-night drill in a lifeboat, cadets of the U. S. Merchant Marine man oars like veterans

Right, pounding wooden pegs into bullet holes in a lifeboat. Pegs were suggested by survivors



Below, marine obstacle course simulates the interior of a torpedoed ship. Note the sloping "decks"



a plastic battery case with a red transparent screw top. Twist the top to the left and the lamp turns on. Bobbing in the sea, its red gleam can be spotted a quarter of a mile or more away.

Chemical flares that you could toss overboard for illumination when you had to abandon ship used to be provided. But the open flame of the flare sometimes set floating fuel oil or gasoline on fire so electric lamps are now used instead. Such a water lamp hangs upside down in its bracket until it is thrown overboard. A weight in the bottom then turns it right side up and a gravity switch automatically completes the circuit, turning on the light.

Not very long ago lifeboats were stocked with a handful of dry sea biscuit and a quart of water per person of capacity. These meager rations were hardly enough for a couple of days. Today concentrated foods ranging from special chocolate bars and malted milk tablets to pemmican are placed in every lifeboat and raft, as well as more copious stocks of drinking water. Most ships carry small barrels of drinking water on their topsides as well, to float away if the ship is sunk and then be picked up by the lifeboats.

You can drink a fish as well as eat it, so hooks, lines, sinkers, and baits are now placed on boats and rafts. In the fishing kit are instructions, printed on waterproof paper, that tell how to catch fish, how to live at sea, and how to survive on a desert island. A medical kit and a small repair kit are also carried.

To drink a fish you chop its flesh into small pieces, place the pieces in a cloth, and squeeze out the juice.

A fish will yield up to more than 10 percent in juice, and this is good to drink. Men have consumed nothing but fish juice and abandon-ship rations for 10 days in tests and have thrived on the fare. For centuries men have been seeking a practical way to convert sea water into water that can be drunk without harm. A chemical mixture recently devised by Dr. Alex Goetz of the California Institute of Technology seems to be one answer to the problem. Injurious salts and substances in sea water are precipitated out of the liquid in a period of two hours. A box of chemicals not much larger than a package of cigarettes treats two quarts of water.

Improvements to emergency equipment start with the lifeboats themselves. Often it has been impossible to launch some of the boats when a doomed ship lists over to one side. The boats on the high side can't slide across the hull to the water. So now lifeboats have metal tracks on their sides that help them skid down the sloping hull. Lifeboat bottoms now have handrails to which survivors may cling if the boat capsizes.

Sometimes a torpedoed ship sinks so rapidly that there is no time to launch the boats. To meet this emergency, large life rafts are suspended above deck in chutes. Cut a rope and the big raft plunges over the side into the water. It always lands right side up because both its top and bottom are the same. Food, water, an orange distress flag, and other equipment are stowed in the center of the raft.

Both boats and rafts have weather curtains that may be raised against spray, and the cloths are colored bright yellow so that they may be sighted easily by rescue vessels. Lifeboat sails are colored red for the same reason. One more suggestion by men who have had to sail in them is that lifeboats be fitted with deeper keels so that they could be sailed across the wind as well as down wind.

Knowing how to handle yourself in an emergency at sea is so important these days that cadets of the United States Merchant Marine are trained, as part of their instruction, in the details of how to abandon ship and how to make the best of it in a lifeboat. While



Cadets of the merchant marine learn many ways to abandon ship. Here they are descending by ropes to lifeboat they have lowered. Below, seaman firing a distress rocket from Very pistol





Cadets overturning a lifeboat so they can practice righting it. Right, turning crank on SOS radio transmitter sends automatic distress signal from life raft

attending basic school they rehearse on a marine-type obstacle course. This is a framework with its top 30 feet above water with ladders, steps, cargo nets, and sloping platforms. It represents most of the conditions that men inside a sinking ship might encounter in making their way up to the deck. Clad in life jackets, the cadets clamber to the top of the structure and then plunge overboard into the water. Sometimes the drills on this obstacle course are held at night.

Spending a night in a lifeboat at sea, too, is another part of the cadet training. Some of them get seasick, some get wet and cold, and all get practical instruction in handling the boat. Watches and lookouts are set, a guard is put in charge of the supplies, and the sail is rigged. The cadets learn how to handle the boat in a heavy sea, how to take advantage of currents, how to avoid exposure, and how to use the equipment on the boat. Small amounts of abandon-ship rations and half a cup of water per man are doled out to them.



When they return to port next morning they've had a taste of what others have gone through and what they may have to go through themselves.

Clothesline Guides Air Cadet in "Postage Stamp" Landing 7397



Clotheslines draped with colored flags and suspended 10 feet above the ground are used by the Army Air Forces to teach flying cadets to make "spot" landings. Pilots attempt to glide their ships over the line and bring them to a halt within 250 feet. This teaches the men to avoid coming in at a steep angle which results in a long roll. The line is made of cord which breaks easily.

71414

Helicopter Lands on Freighter in 20-Foot Space

Challenging the jeep for its ability to get places, the Sikorsky helicopter has been approved for antisubmarine service after successful takeoffs and landings from a 20-foot-square area on the deck of a ship on Long Island Sound. Equipped with pontoons, the R-4 helicopter adopted by the Army Air Forces can be used aboard Liberty ships as a defense against submarines. In sub-infested waters the helicopter can hover low over the sea to spot the raiders, or take off in a hurry to inspect a suspicious oil slick. Tests conducted by the Maritime Commission showed that the helicopter's slow, vertical descent will probably enable it to make a safe landing on a freighter in fairly rough waters. Aside from its ability to rise



"Postage stamp" landing on deck wins helicopter role in fighting subs

or descend vertically, the machine can move forward, backward or sidewise or hover motionless a few feet above deck.

Sea Water Made Safe to Drink by Chemical "De-Salting"

For the first time the "water, water everywhere" that torments castaways adrift at sea may be made safe to drink without distilling. The new method of chemical desalination, or "de-salting," promises to

eliminate thirst as a peril to marooned men. Heretofore, the only way the chemical-burdened waters of the ocean could be made potable was by distillation, impossible in a small boat. The new equipment is designed especially for use on emergency craft, such as the rubber life rafts carried on planes, on which it is impossible to store sufficient quantities of fresh water. The desalination equipment consists of two chemical compounds, compressed to soap-bar size, and four plastic bags, each with a capacity of slightly more than a quart. Eleven parts of drinking water have been obtained to every part of chemical. Under ideal conditions this could be increased to 17 to 1, say experts of the Naval Medical Research Institute, who developed it. The four plastic bags are worn around the neck. The first chemical compound is dissolved in sea water in one of the bags. This precipitates several elements in the water. Next the survivor pours this mixture into another bag that contains a filter sack. At this stage, the product is saltless, but still too alkaline for safety. He empties the water into the third bag, and dissolves therein the second chemical, and finally, filters it in the fourth bag, when it is ready to drink. If necessary, the procedure could be carried out with only two bags, provided each contained a filter sack.



Bags used to purify water are slung from man's neck

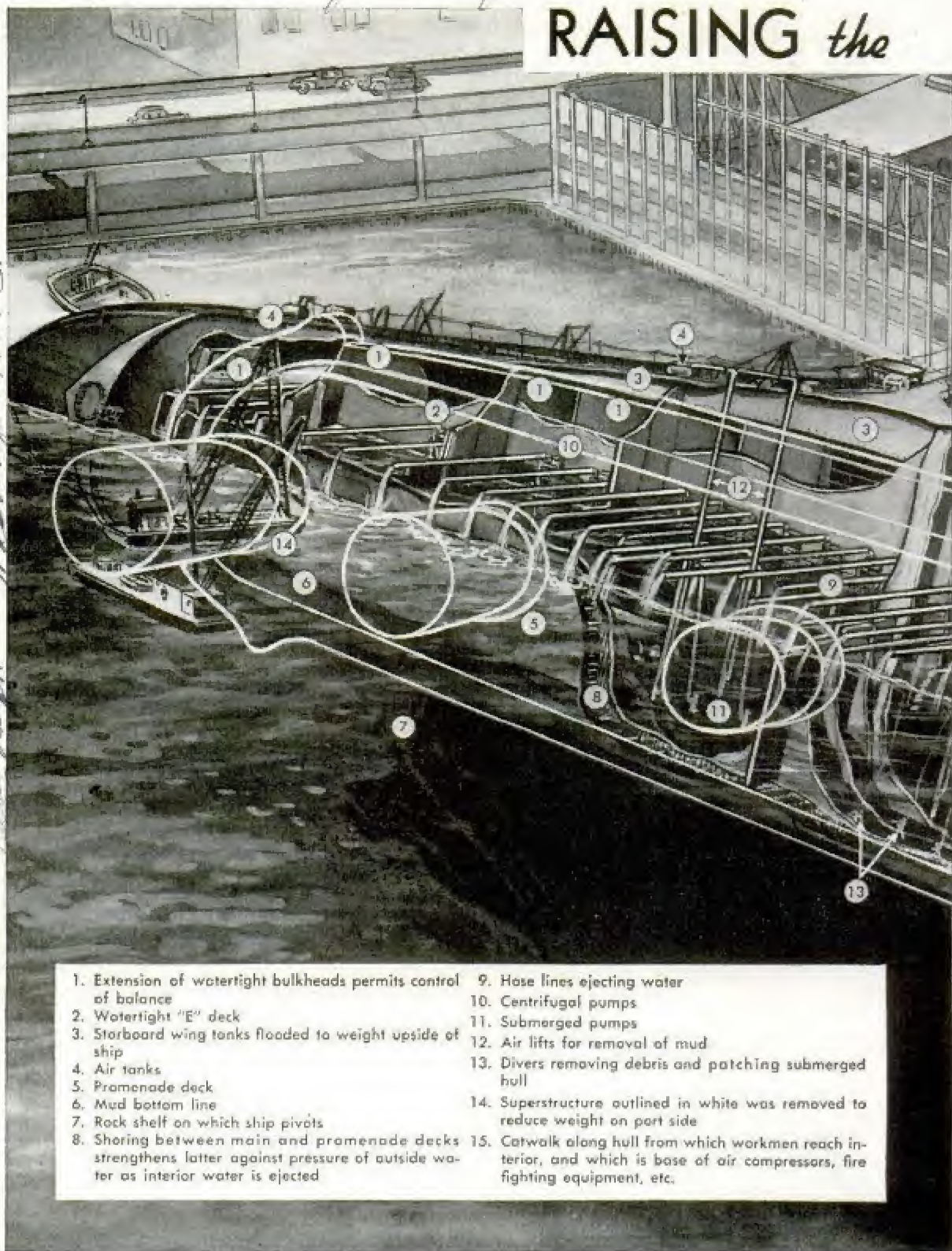
SEPTEMBER, 1943

Bethesda, Maryland
Cpt. William L. Mann
Medical Corps, U.S. Army

Dr. A. C. Grant
Scientific Director

Mr. Logan W. Davis, 1415 W. 43rd St.
New York, N. Y.

RAISING the



1. Extension of watertight bulkheads permits control of balance
2. Watertight "E" deck
3. Starboard wing tanks flooded to weight upside of ship
4. Air tanks
5. Promenade deck
6. Mud bottom line
7. Rock shelf on which ship pivots
8. Shoring between main and promenade decks strengthens latter against pressure of outside water as interior water is ejected
9. Hose lines ejecting water
10. Centrifugal pumps
11. Submerged pumps
12. Air lifts for removal of mud
13. Divers removing debris and patching submerged hull
14. Superstructure outlined in white was removed to reduce weight on port side
15. Catwalk along hull from which workmen reach interior, and which is base of air compressors, fire fighting equipment, etc.

AMONG the Navy's wartime laurels will be one not achieved by gunfire but by engineering skill—salvaging the U.S.S. Lafayette, former luxury liner known as the Normandie. The job of righting some 54,000 tons of ship from between two piers

in New York harbor is called the most complex salvage operation in history. Think of a box that has shipped enough water to tip it over nearly on one side. If water is removed from the underside and forced into the upper side, gravity will tip

NORMANDIE



- | | |
|---|---|
| <p>16. Part of pier may be removed to reduce danger of crash as ship rights itself</p> <p>17. Ship's double bottom being flooded to increase weight on starboard side</p> <p>18. Bulkheads extended from "C" Deck to Promenade Deck</p> | <p>19. Schematic view of single bulkheaded compartment showing isolation of water from other sections, with portholes and hatches sealed against inrush of water. This is approximate site of area lightened to neutralize sinking of stern as ship pivots on rock shelf.</p> |
|---|---|

it back to an upright position. First, 29,000 tons of superstructure and fittings were removed and tons of mud. Watertight compartments had to be built to adjust water weights across ship as well as fore and aft. Original bulkheads rising only to C deck

were continued up to a new top deck. With the installation of the pumps, engineers began the task of lightening one side of the ship while adding weight to the other—an operation made more difficult by the ship's pivoting on a rocky shelf.

71 363

Mirror and Ray Sight-in Rifle Without Firing Ammunition



Sighting-in rifle by light ray, left. Bore plug, below, contains mirror to reflect the beams



Garand rifles can be sighted precisely without firing a shot by use of a mirror-light ray device developed by the General Electric Company. Formerly up to 13 rounds of ammunition were used to sight each gun, and two men and a 100-yard rifle range were required. Now a girl worker can do the job at less than two minutes per rifle in a room the size of an average kitchen. When sighted by the optical gauge, the rifle "fires" a light ray at a mirrored target. The ray is caught by another mirror on the gauge equipment at the operator's eye level and thrown onto a ground glass screen in the image of a cross. Superimposing this image upon a fixed cross on the ground glass correctly positions the rifle, and the gun is then sighted by adjusting its rear sight so that its shadow, magnified 25 times on the screen of a projector directly above it, is in the same relative position as the shadow of the front sight, similarly magnified on another projector above that sight.

71 451

Huge Piles 'Copperplated' To Balk Boring Worms

Termites that attack timbers treated with a special "electroplating" process come away with skinned noses and the wood is left intact. The electrolyte consists of a copper sulphate solution. After a log is peeled and cleaned, longitudinal slots are cut in the timber. Bare copper wire is stapled into these slots which are about eight inches apart. Then the log or pile

is immersed in an ordinary electrolytic tank containing the copper sulphate solution. The solution permeates the outer shell of the wood as it seeks to establish contact with the copper wire which acts as the true cathode. Before this process was developed by the Olympia Wood Preserving Company of Olympia, Wash., piles were soaked in a copper sulphate solution which failed to penetrate deep enough for a lasting effect.

71 207

Non-Slip, Non-Drip Cup and Saucer Used by Navy

Specifications for the United States Navy now require durable dishes, to reduce the amount of breakage—which presumably could be high in rough seas or under the shock of combat—as well as to conserve vital metals for more essential wartime uses. A feature of the fighting ships' new table setting is a plastic cup and saucer, said to be "non-slipping and non-dripping."



Navy dishes must be durable. Inset, nonslip cup and saucer

Schmidt, M. J.

Mr. Calvin *71247*
Telescope Shows Plane Tire's Centrifugal Bulge

Army, Ohio
Design of entire airplane wheel assemblies may be affected by the amount of radial growth of the plane's tire in operation. To test the amount of this growth under simulated operations, B. F. Goodrich Co. has developed a machine to whirl an airplane tire at high speeds. A scale is set up behind the tire, and an operator sights through a telescope to mark the spot at which the outer circumference of the tire hits the scale. As the tire's revolutions are speeded up, new readings are taken, and the difference in scale readings is the amount of radial growth.

In actual operations, an airplane tire "grows" radially. This testing device enables designer to measure this growth on a scale seen through a telescope while tire whirls



71166
Rangers Use Tight-Rope Bridge in Graduation Test

Neither piers nor pontoons are needed by Uncle Sam's ace shock troops, the battle-proved Rangers, to force the crossing

of a stream in the face of enemy fire. As part of their "graduation exercises" after a course in Ranger tactics, members of a motorized division strung an improvised bridge, made of one rope for a footpath and two others for handholds, connected by rope crosspieces, to span a stream in the face of simulated enemy defensive shelling so realistic that explosions in the stream enveloped them in manmade geysers.



With one rope for a footpath and two more used as handholds, U. S. Rangers bridge a stream during a graduation exercise, as a water geyser douses them from simulated shellfire

Lieut. Andrew Hayworth
1155 Akron St., San Diego, Calif.



U. S. Navy photos

Small Jap flags on conning tower and beards of this U. S. sub crew speak volumes. Below, diving bell trains crew to escape



THE American submarine was inside Tokyo bay. The skipper decided he'd better get out of there fast. So he gave orders to surface so he could take one last look-see before heading back home.

As his periscope broke the surface, he saw he was near a Japanese shipbuilding yard. Closer inspection revealed an enemy aircraft carrier under construction and almost completed.

"Good Lord," he said breathlessly to his executive officer, "the Japs are getting ready to launch that flat top. I'd like to stick around for awhile. . ."

The exec said, "Our supplies are getting low and it's dangerous to stay here too long." And then added, "But I'm with you. . ."

For three days the American submarine hovered near that Japanese shipyard, watching and waiting.

At last the launching was about to begin. The Nipponese vessel was draped with ribbons and flags. Silk-hatted, slant-eyed dignitaries gathered at her bow. The American crew was tense as their commanding officer peered intently through his periscope at the scene.

As the enormous Japanese car-

rier began to rumble down the ways, the submarine skipper said crisply: "Fire One!"

The first torpedo roared out of its tube, followed by three more. As the Jap flat top entered the water, two of the tin fish found their mark. With a tremendous explosion the new carrier continued straight to the bottom of the harbor.

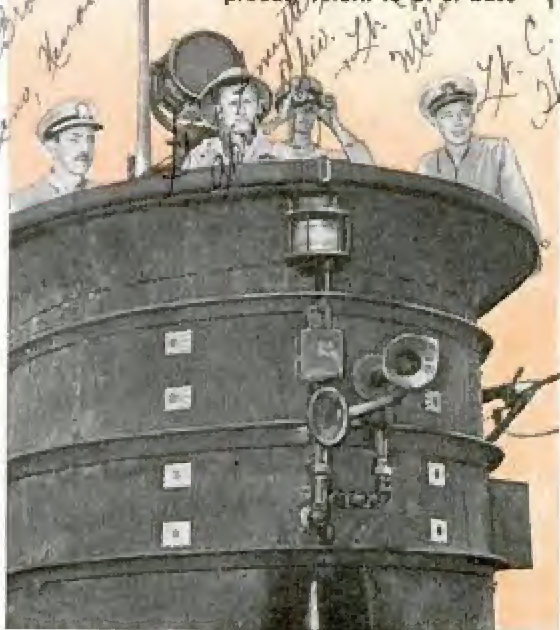
Such is an unofficial story that has been circulating since shortly after the war began. No Navy officer will swear it's true—but it might well be.

Submarine men belong to an arm of

Right, each torpedo on flag held by two members of sub crew denotes one sunken Rising Sun vessel



Below, with their victories recorded on tower, the men proudly return to U. S. base



Training sub gets under way at New London, Conn., as Diesel engines roar and exhaust pours from ports

the Navy known as the "silent service." They're a taciturn, close-mouthed lot. They're picked for their cool courage, their dependability, their calmness and their self-possession. Such men do not do much boasting.

But more than that, the nature of their wartime job lies beyond the newspaper headlines and radio loudspeakers. Submarines must operate in secrecy. When one of them sends an enemy vessel to the bottom, there is nobody to applaud. And when one of them goes down by mine or depth charge, news of the loss is withheld.

In spite of the fact that it is difficult to



When order is given to "lay below" trainee leaps toward ladder. Right, picture made by periscope of a Jap victim

get any real news on the activities of the "silent service," a few yarns of real courage and heroism have come back from the Pacific.

After the attacks on Pearl Harbor and Manila, American air and surface power was seriously crippled—at least temporarily. But the submarines came out of their corner swinging.

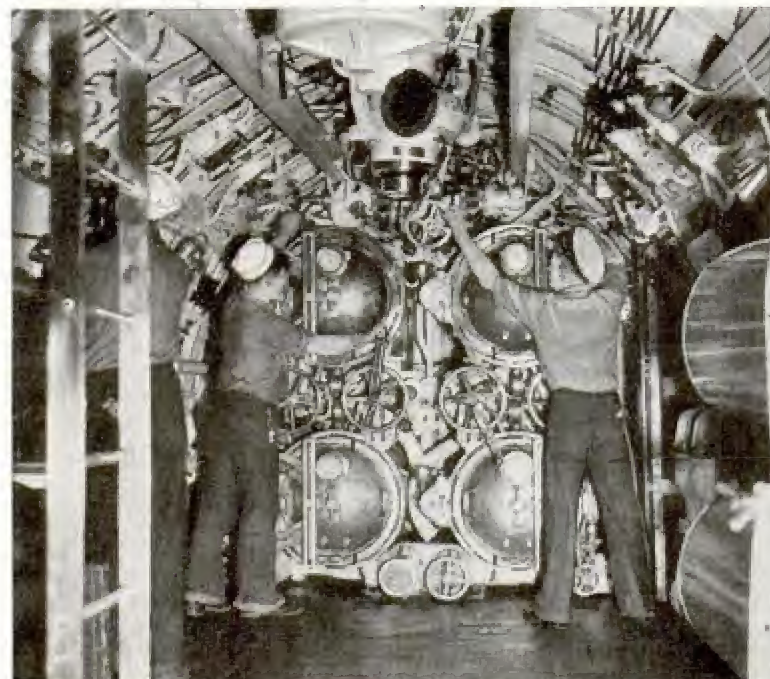
Admiral Chester Nimitz said recently:

"From the very beginning, our submarines began taking a toll of Japanese merchant shipping and an occasional man-of-war. And as our submarines increased in numbers, the rate of enemy sinkings increased accordingly.

"As we moved nearer to his shore installations, our meetings were more frequent, almost a daily occurrence. Our submarines have given an excellent account of themselves."

When the U. S. fleet

Operating intricate controls of the four tubes inside the torpedo room of U. S. raider



was attacked at Pearl Harbor and Manila, the Navy had all its submarines in service. Another 73 were being built while another 23 were on order. Since then, an unspecified number has also been ordered.

Details on submarines are meager, and beyond a few general facts the Navy says little about its "pig-boats." Most modern American submarines range from 1,500 to 2,000 tons and are from 250 to 300 feet in length. Speed is from 20 to 22 knots while on the surface and from 9 to 11 knots under water. From 40 to 65 men make up a crew. Armament usually consists of



Harrison Miller painting, from U. S. Navy

This "fish eye" view of torpedo fired from sub undersea is a favorite painting of men in the service. Below, trainee in New London school tank comes up line with Momsen lung

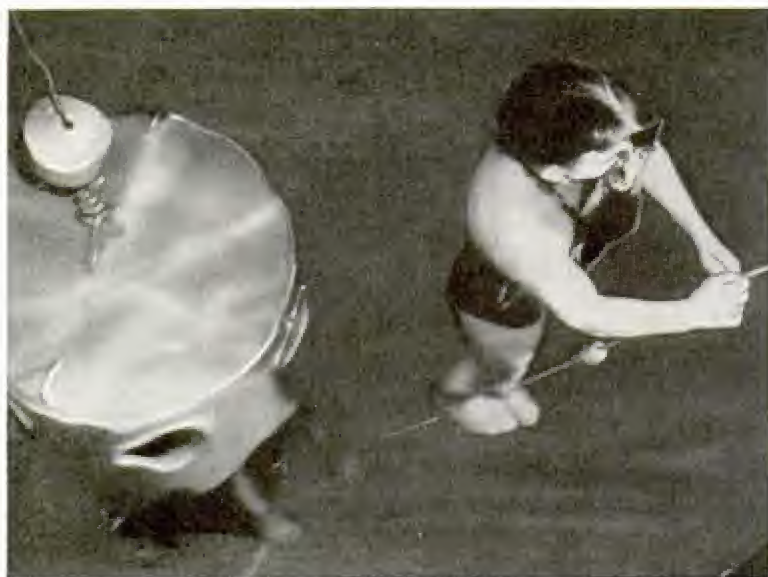
a single 3- to 5-inch deck gun, anti-aircraft guns and 6 to 12 torpedo tubes.

In Manila bay, submarines performed yeoman work. While Japanese bombers flew over by day, the subs sank to the bottom. At night they would rise to the surface to load their precious cargoes. When Manila fell and the American forces moved to Bataan and Corregidor, it was the black-hulled American submarines that carried most of the food and ammunition to the Army.

After the surrender of Corregidor, American submarines were forced to seek other bases from which to operate. They found them all right and since then have played an important part in the sea battles of the Pacific.

Lieut. Frank Lawson was aboard one of the American submarines which left Manila for another base.





The handpicked members of every U. S. submarine crew learn how to make their escape from stricken raider. Here trainee is leaving diving bell

Shortly after the underseas boat had put in at the new base for re-conditioning, it was greeted by a 500-pound Jap bomb which was dropped on a pier several hundred yards away.

The submarine submerged immediately and gun crews manned machine guns from the deck, which remained awash. The dive bomber was driven off before it could do any serious damage.

Then the American "pig boat" went hunting Jap ships. The first night out, the sub surfaced right in the middle of a large number of Nipponese vessels.

"Fortunately," said Lieutenant Lawson, "we were well protected by foggy weather. The Japs didn't see us but we could distinctly see the silhouettes of their vessels. So we picked out the two largest, unleashed our torpedoes and dove for the bottom.

"As we were going down we heard two large explosions and something that sounded like a third. At any rate, we were credited with two Jap ships. The next two days we played hide and seek with Japanese warships, but they finally gave up the chase."

Because of the hazards of their job, submarine men are paid a 50 percent bonus—the same as fliers. But fear seems to play no part in their lives. As a matter of fact, a seasoned submarine man will tell you there's no better branch of the Navy.

Looking forward into quarters of captain; seaman at left is steering ship

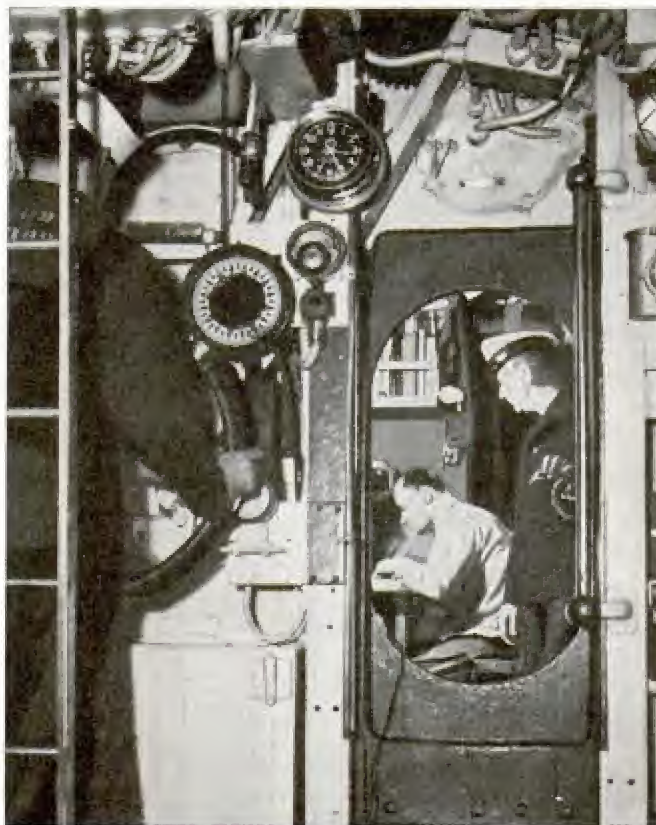
Harold Carrico, torpedoman first class with a record of 16 years in the Navy, recently told of his submarine being damaged in the Battle of the Macassar Straits between Borneo and the Celebes.

Damaged while on the surface by a Japanese bomb, the American sub rolled over on its side and the crew clambered out and up on the side of the stricken vessel where they remained 47 hours.

"As we lay hungry and exhausted, Japanese Zero fighters spotted us and strafed us with machine gun fire," said Carrico. "But every man lived, and so far as I know are still in the service. Submarine men always go back to 'pig boats'."

Much has been made of the teamwork of eight men aboard a giant four-motored bomber. But that kind of teamwork, measured in hours, can't begin to touch the kind of teamwork required of 50 men in a submarine for weeks at a time.

They're all hand picked men, these submariners, and the finest in the Navy. First, they must be men who can be depended



on to do a job right. Second, they must have a quiet poise and self-assurance. And third, they must have the stamina and patience to be able to get along with their shipmates in cramped quarters.

Even such a personal and intimate thing as "B.O.," which the doctors call bromidosis, will disqualify a man for the submarine service. If their best friend won't tell them, the Navy will.

Once he is picked for submarines, a man must go to school to learn all there is to know about Diesel engines, storage batteries, torpedoes, gyro-compass and underwater sound and radio. He gets practical experience in using a Momsen lung so that he can get out of a damaged submarine alive—if he must. In a war of specialists, he ranks right at the top.

The submarine in the Pacific is just as important to the United States as it is to Germany in the Atlantic. Japan is an island nation with long lines of overseas communications.

Many naval experts believe that this vulnerability to submarine warfare is Japan's fatal weakness—her "Achilles heel." In a long war of attrition in the Pacific, it is believed that America's growing submarine fleet will finally strangle Japan's seaborne commerce. They point out that so far our submarines have sunk more Japanese ships than have our planes—at a much smaller cost of manpower and

equipment. Proof of the effectiveness of submarine warfare against Japan is seen in the weatherbeaten American subs that come into Pacific bases—with 8, 10 or 12 little Jap flags painted on their periscopes.

In this pressure chamber, husky future submariners soon learn whether they can stand rigors of the undersea "silent service"



It's a tense moment for the crew when the order comes to crash dive. Subs on patrol stay below during the day, do their hunting at dawn or dusk and surface at night to charge batteries





With a great splash the U.S.S. Puffer, fourth submarine to be built on the Great Lakes, is launched on its side at Manitowoc, Wis. Like all U. S. submersibles, it is named for a fish

Each one represents an enemy ship sunk.

Lieut. Comdr. Henry Chester Bruton, skipper of an American sub with 11 little rising suns on his periscope, told recently of how he got a Jap troopship almost within sight of the Japanese mainland.

"We missed her on the first attack, chased her several hours and finally sank her. We saw her bow in the air and then she went down. We learned later there were 400 soldiers and 200 civilians aboard, in addition to the crew."

Another American submarine crew got

so close to Japanese-held territory that, as one of its officers, Lieut. Slade Cutter put it, "you could almost spit on the coast."

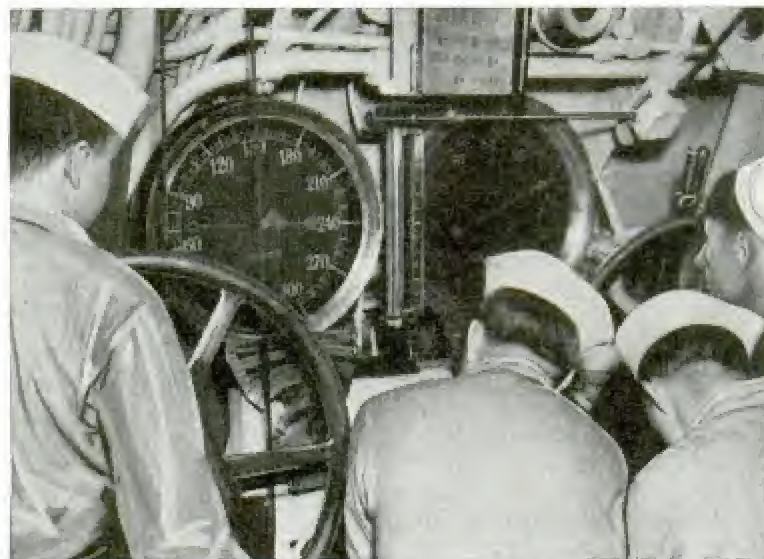
This particular crew, which already had to its credit a big transport, a destroyer, two patrol boats, two tankers, an inter-island ship, a trawler and a freighter, was ordered to reconnoiter an island in preparation for an American raid that was to follow a few days later. For five days the sub made careful observations. Her crew, itching for action, grew anxious as small ships left the shelter of the lagoon. All of them made perfect targets.

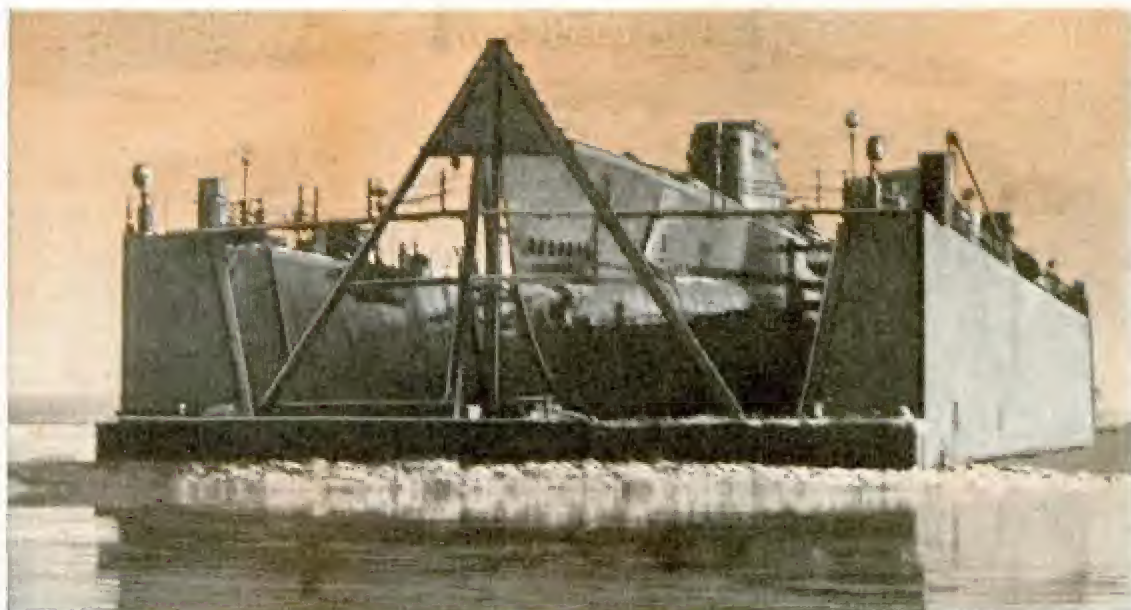
"But the skipper let all of them go by," Lieutenant Cutter said. "He figured there must be some big ones in that lagoon."

"He was right. On the fifth day a big baby came out—a transport. We let four torpedoes go and sank her."

Many improvements have been made in submarines since the last war. Today they are bigger, stronger and have a longer cruising radius.

These seamen are easing a "tin fish" into one of torpedo tubes





In this huge floating drydock, the submarine Peto built on the Great Lakes was towed down the Mississippi River to New Orleans where she was fitted out to join the growing undersea fleet

Depth bombs must explode within 15 feet of them to do serious damage to the hull.

Measures for the safety and comfort of the crew have also been improved.

Submariners get food that compares favorably with that of any high-priced restaurant. Because of the lack of recreational facilities aboard a cramped submarine, the most popular sport is eating. Extra ration money provides thick, juicy steaks, turkey, frozen fruits and vegetables, and pies and cakes. Good food keeps morale high.

Because submarines stay submerged by day and come to the surface only at night, the crews may not see sunlight for weeks. To keep health at a high level, vitamin

tablets and ultraviolet ray lamps are provided. Special chemical preparations absorb carbon dioxide breathed out of the crew's lungs—thus tending to keep the air within the submarine sweet and fresh.

Military men who look ahead see many interesting possibilities for the submarine. One is a huge troop and cargo carrying submarine which would be immune to air and surface attack. Another is an underwater aircraft carrier. Another is a submersible cruiser which will be armed with heavy guns and come to the surface to do its fighting. A fourth possibility is a submarine "mother ship" which will loose a flock of "baby subs" in enemy waters.

Motorized Pre-Flight Trainer Never Leaves the Ground

To further speed up wartime pilot training, a motorized pre-flight trainer is in use on the West Coast. Although it never leaves the ground, its midget motor pulls the craft along the ground at speeds as high as 40 miles an hour. The ship, operating on a pivot, can bank, turn, and otherwise simulate actual flight.

With its tiny motor perched on the nose, this pre-flight trainer is readied for the "takeoff." It speeds along ground at 40 miles per hour

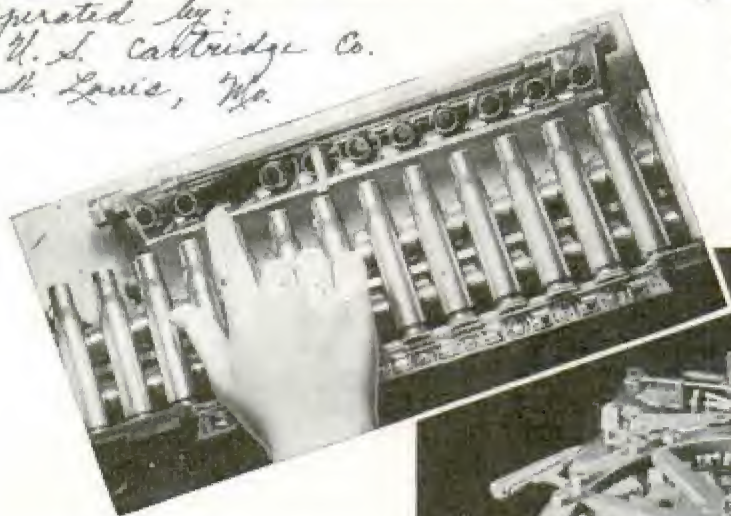


*Dr. C. M. Meadors
Civil Air Patrol
Los Angeles, Calif.*

Bullets Ride Merry-Go-Round in Weight Test

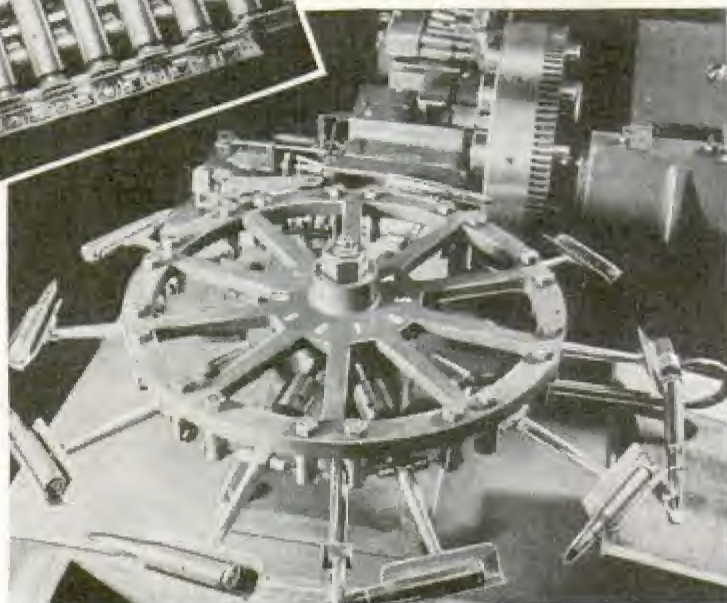


*Operated by:
U. S. Cartridge Co.
St. Louis, Mo.*



Precision-made rifle and machine gun cartridges are given scores of inspections. At top, samples are selected for a "final exam," actual firing before acceptance. Above, a slanted mirror lets inspector view inside of cartridges. Right, "merry-go-round" scale automatically throws off any cartridge of improper weight

Among the 90-odd inspections of rifle and machine gun cartridges at the St. Louis Ordnance Plant is one in which the bullets ride a "merry-go-round." Each of the 10 spokes of this "gage and weigh" machine is a scale, so delicately balanced that a cartridge will be rejected if its weight is one grain too great or too small—and there are 7,000 grains to the pound. Lightweight cartridges ride high, heavyweights ride low, and each is automatically kicked off into a separate bin. In another inspection procedure, cartridge cases roll at a slight angle beside a mirror, tilted so that an inspector can look down its throat to see that it is perfect, and that no foreign matter has lodged inside. A second mirror reveals whether the primer is properly seated. As a final inspection procedure, random samples are taken from every lot of finished ammunition and fired for accuracy, penetration, and other factors. Though cartridges look deceptively simple, their mass manufacture at this 300-acre plant, which turns them out by the hundreds of millions, demands more than 200 precision manufacturing operations. The finished products are sleek and deadly implements of warfare. Certain measurements are held to tolerances as close as one ten-thousandth of an inch.



Artists Reproduce Naval Battle on Table Top



Panoramic battle scenes, based on cabled stories, are designed by one newspaper by use of miniature ships, clay islands, bits of cottonwool for bursting bombs, paper oceans and skies, strings for roads, and plastic villages. Left, staff begins work on battle scene to be photographed

Right, the completed panorama—a pilot's eye view of a battle in the Solomons, with U. S. and Jap ships maneuvering, bombers winging overhead, shells bursting, near misses sending spray aloft, and barges making for the shore



Illusion of movement, space and depth is created by designing a three-dimensional model for the photographer. Editor's sketch of the battle scene is sent to the art department. The exact location of every ship engaged is plotted from the wired story. Photographic paper is used for the sea, islands are molded of clay, and villages are designed from paper, pins and plasticine. At left center, artist uses "process white" to paint ship's wake; he could also use shaving cream for this purpose. Sky in background is vertical sheet of air-brushed paper. Lengths of white string form the roads ashore. Bottom, the size of the miniature ships is shown; artist holds an entire "pocket navy" in one hand. The midget fleet is carefully set up in a formation predetermined by the editor. The completed "set" is a table-top battle. Training lamps upon the scene enables the photographer to shoot the picture from any angle, to gain realistic effect





BATTLE LOG of the LIBERATORS

Twenty-three women who help build the planes stand along wing of a Liberator, Consolidated's B-24 bomber

IF THE United States chose to build only one type of warplane it might very well specialize on its famed mass-produced "workhorse of the war," the Liberator B-24 bomber.

During its short career the Liberator B-24 has carried the war to the enemy in all parts of the world and yet its record to date is hardly a beginning. More Liberators are being built this year than the total of all aircraft production in the United States only a few years ago.

Its battle log makes impressive reading. . . "Liberators sink 10,000-ton Italian cruiser" . . . "Liberators dump 15 tons of bombs on Kiska" . . . "B-24 destroys German sub in Gulf of Mexico" . . . "Sink Jap ships in Aleutians" . . . "Carry full bomb load at 10,000 feet to target despite two engines knocked out by antiaircraft fire" . . . "Liberators detect and help destroy Jap convoy in Bismarck Sea" . . . "B-24's knock out German fighter planes in ratio of 4 to 1."

On one front, the Mediterranean, Liberators have done virtually all the long range strategic bombing. In nine raids alone the Liberators dumped 600,000 pounds of explosives on shipping and installations in Naples harbor. The flights averaged 10 hours in length, bombing was of the "pin-point" style, and the bombers protected

themselves so well against attack that fighter escorts were unnecessary. In 600 missions the Liberators dropped 4,500 tons of bombs on such Axis targets as Bengazi, Tripoli, and points on the Italian mainland.

The cargo version of the B-24, called the Liberator Express, together with other transport planes, is said to be flying as much freight into China as was once carried over the Burma Road. It was a Liber-



A Consolidated-Vultee engineer dressed for a trip in the high-altitude chamber where temperatures will be dropped to those encountered on a bombing trip

ator in which Wendell Willkie flew around the world and it is a Liberator that serves as Churchill's personal airplane for his trips to Russia and Africa.

A Liberator holds the speed record for crossing the Atlantic, one of them having made the trip in six hours and 40 minutes. Another Liberator has made 27 round trips between the United States and Australia, once making the run between the continents in less than a day and a half. It was a Liberator that early this year became the first "aerial Flying Dutchman," flying for 2,000 miles without a soul on board. Abandoned in the air over the Gulf near Florida by its crew, it flew on until it crashed into a mountain in Mexico.

The Liberator is a 28-ton four-engined, twin-tailed, long-range, high-altitude bomber. It can carry a bomb load of six tons. It can fly across the Atlantic and return without refueling. Its wingspan is 110 feet and the nose gunner is 66 feet in front of the tail gunner. The plane has a maximum speed in excess of 300 miles per hour, can climb to 35,000 feet, and carries a crew of up to nine men who can defend their craft with .50 caliber machine guns from turrets so arranged that enemy fighters can't find a safe angle for attack.

It is a brute for punishment. Most of the bombers return from raids untouched and even when one runs into damaging



Gunner manning the twin .50-caliber guns in tail of Liberator must not be taller than 5 feet 10 inches nor heavier than 160 pounds because of cramped space

The Liberator Express, below, is the cargo version of the B-24 and can carry more than 6 tons of freight over 3,000 miles. It is also convertible for troops





A mechanic checks the radio antenna wires on tail of Liberator

opposition it usually manages to limp home. It is not often that a single antiaircraft shell destroys a big bomber. A Liberator B-24 that fails to return is most apt to have been lost because of a multiplicity of hits that finally reduce its engine power to zero or tear its whole control system apart.

Sometimes a couple of the men may have to fight a fire on board while the rest of the crew fight off enemy planes. Emergency repairs of battle damage during a flight are a common story. Crew members may have to remedy broken control cables, damaged hydraulic lines, or faltering engines while an air battle rages around them.

Some vital spots are protected by armor, and now the crew members themselves are beginning to wear steel helmets and body armor to protect themselves from shell fragments. Frostbite at high bombing altitudes has been another hazard and the Liberators are equipped with heaters to provide warmth when needed.

There seems to be no question about the superiority of our

bomber gunners over Jap and German fighter pilots. In 50 operations against European targets America lost 90 Liberators and Flying Fortresses, yet in the same operations our gunners knocked down 356 Axis planes. The bombers cluster together in tight formation when attacked in the air so that scores of gunners can concentrate their fire against the oncoming enemy planes.

When it was decided to put the Liberator into mass production, Consolidated-Vultee Aircraft Corporation wanted to utilize mechanized assembly lines. Automotive production experts said it couldn't be done, then pitched in to help make the impossible come true. Today Liberators are being built by the same efficient methods once used to build automobiles, in spite of the fact that one of the big bombers contains more than 100,000 parts exclusive of half a million rivets, nuts and bolts.

The mass production of Liberators at various plants scattered across America is one of the reasons why the aircraft industry is vaster today, in respect to the value of its output, than was the automobile industry in its biggest year. Ford's bomber plant at Willow Run, built to produce Liberators at the rate of "one bomber per hour, on the hour," suggests the numbers of Liberators



Loading aircraft engines into a C-87, the army's designation for the cargo-carrying Liberator used by Air Transport Command

that are getting up into the air even though Willow Run's tremendous goal has not yet been attained.

Factories had hardly geared up for assembly line production of the 28-ton bombers when Consolidated-Vultee put its Coronado patrol flying boat on the same mass-production basis. This plane weighs 33 tons, the largest thing in the world built by assembly line methods. But it won't be for long and today com-



Above, checking "artificial altitude" in Consolidated-Vultee laboratory "cold room." Left, nose wheel assemblies ready for installation at the factory



are being put together by new methods that allow more speed. The Liberator nose section once required 6,000 man-hours to complete, now it is being built at 33 times the former rate of construction by one third the number of workers.

This miracle is performed by building the nose structure and then taking it apart again temporarily so that the maze of panels, piping, conduit, and wiring can be

Before a B-24 takes off on an errand to enemy country a mechanic makes a final check of its engines

pany engineers are confident that if necessary they could build anything up to the size of battleships by the same efficient method.

The metal structures of present airplanes consist mainly of aluminum and its alloys; with the advent of the great airplanes being considered now, steel will take to the air. Sheet steel, for instance, seems to be a desirable wing covering material in big aircraft. Steel would give an airplane a life that compares with the life of a railroad locomotive.

Mechanized assembly lines tell part of the story of building Liberators in volume; breaking down complicated structural processes into simple operations that can be performed by relatively unskilled workers is a companion reason. Sub-assemblies





U. S. Army Air Force photo

Every crew regards its own plane as a member of the family. This one, fondly nicknamed the "Old Gray Mare," is given a thorough going-over by mechanics at an army field before going into action

fitted into their places rapidly and easily.

Half a dozen or more different kinds of plastics go into a Liberator, 1,700 pieces in all that weigh about 500 pounds. They are used not as substitutes for metal but because they are lighter and better than metal. Thus the plane's wheel well domes used to be shaped from aluminum alloy that weighed 32 pounds per dome. Laminated cloth and Fiberglas domes save 34 pounds per plane. A plastic anti-icing tank that weighs seven pounds replaces a former tank made of aluminum alloy that weighed 22 pounds.

Consolidated-Vultee engineers don't believe the aircraft industry will come to a sudden halt the minute peace is signed. The air age is here, and fast freight and passengers tend to move over the Great Circle routes that air travel makes possible. New York and Chungking are a month apart by train and ship, yet separated by only 38 hours of airplane travel. The point is, military airplanes won't be worth much as peacetime cargo carriers. Their fuselages are designed to carry small, heavy loads and their horsepower in relation to the loads carried is tremendous.

To pay their way, commercial cargo carriers will need large fuselages in which bulky mer-

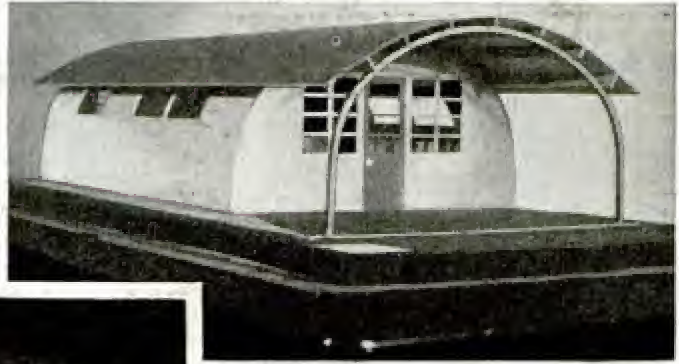
chandise can be transported, and no more horsepower than is necessary to move such loads rapidly and economically. The engineers believe that although some ex-military airplanes will be pressed into service as cargo carriers, they will be used no longer than it takes for the industry to design and build great transports that can do the peacetime job better. Planes designed specifically for cargo are already on the way.



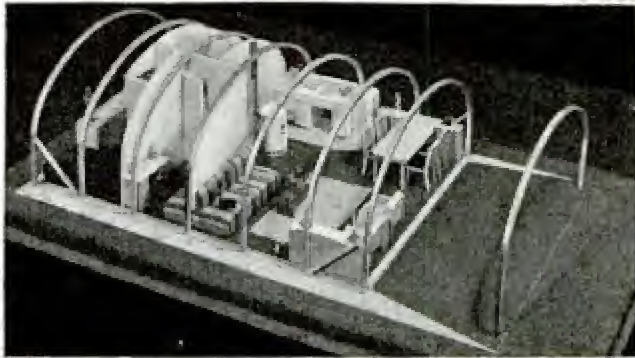
Lowering a completed tail assembly into place on fuselage at one of the Consolidated-Vultee plants. The twin tail is one of the distinguishing features of this 28-ton, four-engined, high-altitude bomber

Wartime Home Built and Furnished for \$1,000

Designed as an emergency unit for temporary use in communities where acute wartime housing shortages exist, a Victory House designed by the John B. Pierce Foundation accommodates a family of four and can be built and completely furnished for less than \$1,000. It is basically a substitute for life in a trailer, and is



Roof shields sloping windows from weather



Laminated wood arches enclose roomy interior of war house

based on use of laminated wood arches shaped to produce a roomy interior. Covered with pulp-board, this frame supports a double wall and roof which can be further insulated. A third layer of pulpboard, coated with asphalt roofing, is supported

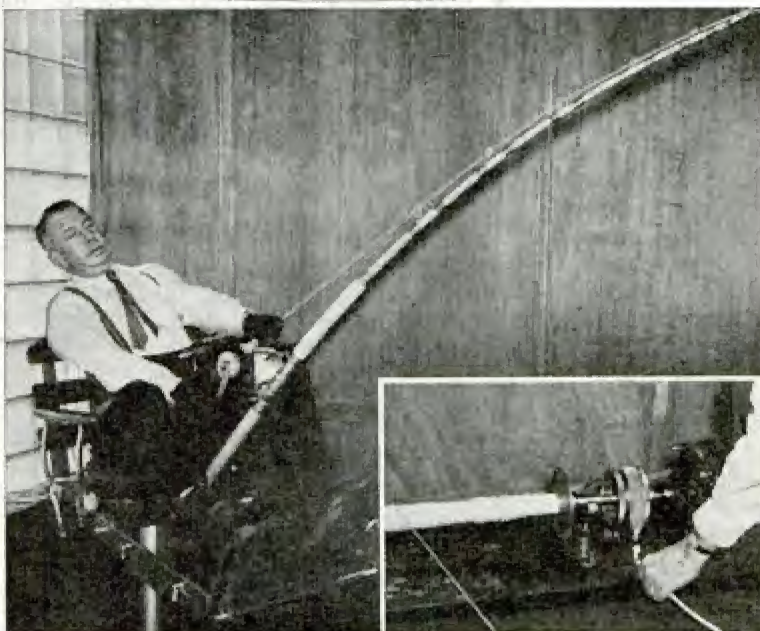
above the arch proper with a ventilated air-space between for insulation against the sun's heat. The added layer also shields the sloping windows from sun and rain. With a realistic approach toward the problem of priorities, the Victory House uses no plumbing nor electrical wiring. Sanitary facilities consist of a kitchen sink, which drains into a dry well, a washstand and a chemical toilet. Illumination is from kerosene lamps. The mechanical equipment was kept meager, for some more elaborate houses have been finished, only to stand empty, waiting for priorities for utilities.

Deep-Sea Fishing Indoors Provided by "Electric Tuna"

Not even war's restrictions on pleasure sailing can keep your confirmed deep-sea fisherman from rehearsing his favorite sport, as Maj. Aaron E. Carpenter, well-

known Philadelphia angler, demonstrates. In his office, he has a standard fighting chair, 30 feet from a closet in which is a small electric motor turning a wide spindle, and also equipped

with a leather brake. For fishing practice, the line of his heavy rod is hooked to the spindle, then the motor is run a brief period to simulate the first run of a hooked tuna. The brake is then tightened, and by means of small weights is kept at uniform tension. The angler then proceeds to "work the fish," with a penalty, if his line grows slack, of another few seconds' run of the motor. A red marker tied to the line shows when the fish is "landed."



Office fisherman in fighting chair. Inset, spindle revolving simulates run of a tuna
Courtesy Philadelphia Record

INDUSTRY'S Mr. FIX-IT



without such departments. The foundation helps any industry with a problem.

Take the potato shippers for an example. Their problem was bacterial soft rot, a condition that can set in and spread through a carload of washed potatoes ready for shipment. Sometimes rot occurred in as much as 40 percent of the spuds in a carload.

The shippers thought they knew how to prevent rot, and came to the foundation for advice on their method. The result was the development of a dryer, basically a conveyor belt carrying the potatoes through a hot-air blast, causing a change in the skins that arrested the bacterial infiltration.

The result: Thousands of shippers' dollars saved, and the end to one peril

Day's work for this foundation might range from baking ceramics to making strain-gauge tests (below) of hammer on tank

"HOW can I keep potatoes from rotting in freight cars?"

"Where is my bridge most likely to break?"

"How does a parachutist's heart act when he bails out at 30,000 feet?"

"Do you have any substitutes for sand?"

These are typical questions asked in a sort of industrial "Information, Please," of the experts at the Armour Research Foundation in Chicago, affiliated with Illinois Institute of Technology. And the problems rarely stump the experts.

Launched six years ago, with three men, three rooms of an old apartment house, and \$30,000, the foundation now boasts staff scientists by the score, several whole buildings, a budget running over a million dollars annually, and savings to industry running into many millions. And it's all been accomplished on a strictly not-for-profit basis.

Although many big companies have their own research departments, these companies are users of the Armour Foundation service even more than the companies



Industrial Research Foundation, of which is Director

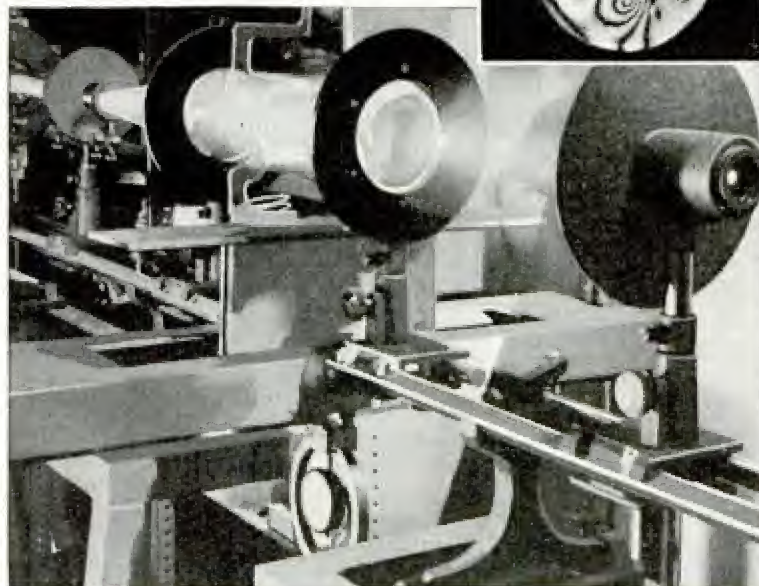
to the annual shipments of 300,000,000 bushels of potatoes.

Industry's headaches are brought to the experts for diagnosis and cure. A fountain-pen manufacturer came up with one of the first problems Harold Vagtborg, the foundation director, and his associates solved. This manufacturer pointed out that business men, carrying fountain pens in airplanes soaring at high altitudes, frequently came back to the ground to discover that they had a pocketful of ink.

It was readily ascertained that pens leaked because of the greatly reduced pressure at higher altitudes. But the diagnosis was easier than the cure. The foundation spent a year studying every formula of physics, and finally came up with a model that withstands both the extreme low pressure of airplanes and the extreme high pressure in submarines.

If you, as an industrialist with a manufacturing problem, ask aid of the foundation, after a preliminary examination you would be presented with an estimate of the cost of solving it. Included in the estimate would be the cost to the foundation of the materials and tools to be used,

Photoelasticity test shows on plastic model where stresses would occur on object. Inset, model of hook shows lines of stress



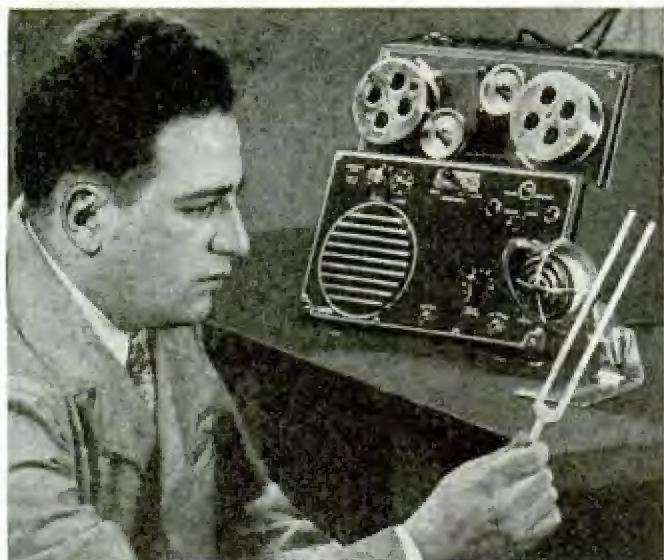
All the foundation's work aims at lessening industry's headaches. Here, expert measures the flow of air through the outlet of ventilating system

together with the staff salaries and overhead involved in the solution.

After your problem was solved, the solution would be all yours. None of your competitors would have access to the foundation's findings; what you paid for, you'd receive exclusively — theories, methods, patents, and maybe even a small-scale, completely operating factory.

During its first six years, the foundation undertook 167 long-term industrial investigations, and 3,781 short-term ones, for in all 1,249 project sponsors — companies, associations of manufacturers and government agencies. With the advent of war, research was stepped up many-fold. During odd moments as well, all the staff helps out on projects originated by members of the foundation itself.

Listing some of the long-term projects shows the broad capabilities of its staff. They include research in fields of acetylene, automatic lighters, electronics, glass containers, high-pressure gases, meat processing, sewing machines, soil studies, tractor treads, cosmetics, ore bridges, chewing gum, rubber salvage, pencil



Wire recorder, perfected at foundation, is self-contained recorder and player, using wire .004 inch thick as the "record"

leads, and Venetian blinds. For his single fee the industrialist has access to men with skills ranging from the most abstract to the most matter-of-fact.

If a manufacturer wished to know how long a new metal alloy might be expected to wear, work on his project might include microphotography by one expert, stress-testing by another team, cold and heat testing by others; impact tests by a physicist, chemical analysis by a metallurgist, and actual wear-tests by mechanics. The net findings boil down the reports of perhaps a score of men—or several score.

Often a project requires that foundation experts dream up absolutely new tools and methods. The tools may then become part of the laboratory equipment. One such is a tubelike device built to determine the sound absorbing properties of certain materials, now resting until after the war in a place of honor in the lab.

One much-publicized bit of research was the testing of clothing and equipment used by Arthur Starnes in a free fall of almost six miles from a plane over the Chicago Municipal Airport. He was to be the guinea pig in a test of a flier's physical reactions when he bails out in the stratosphere—to fall nearly 30,000 feet before opening his parachute. To protect his life, his equipment had to be tried out in advance. So Dr. Francis Godwin, assistant director, built the

Ingenious mixer consists of four rollers turned by motor. Barrel contains substances to be mixed

foundation a piece of stratosphere.

A chamber was constructed within one room, and the parachutist was dressed in strato-clothing, given the camera he was to buckle onto his body, and the tiny transmitter that eventually broadcast his heartbeats during the free fall, and placed in the chamber, whereupon the temperature was reduced to 67 degrees below zero, and a 200-mile-an-hour wind was blown into it—simulating the conditions of the fall. Thanks to the pre-testing, Starnes' fall came off safely.

Dr. Thomas C. Poulter, scientific director of the foundation and renowned as designer of the "Snow Cruiser" Admiral Byrd took on his last Antarctic expedition, found in the course of the expedition that excessive cold

would in effect "freeze" his miniature camera. Sprocket holes in the film would tear away, before the film would turn. So he designed a tiny coil heater, operating from a dry-cell battery, to warm the apparatus sufficiently to turn the film. He also discovered that for every 50-degree drop of temperature, the camera should be opened one full stop, to compensate for lowered film sensitivity in the cold.

Sights, sounds and smells of a carnival House of Magic play on the senses of a visitor to the domain of the "Mr. Fixits," but there is nothing but deadly earnestness in the way they approach their work, much of which is now of a secret military nature.

One prize exhibit bears the jaw-cracking name of magneto-strict-ion oscillator. In effect,



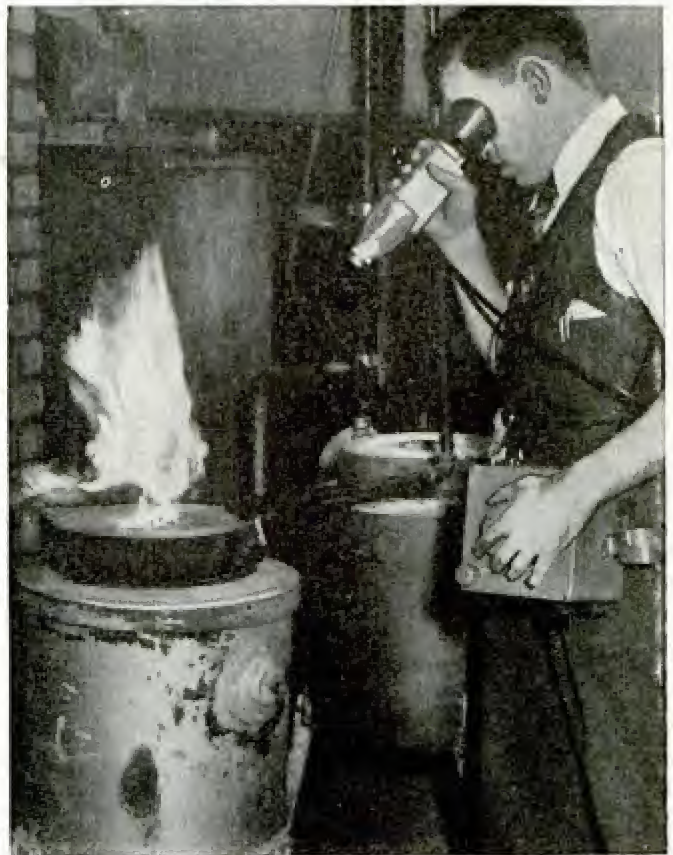
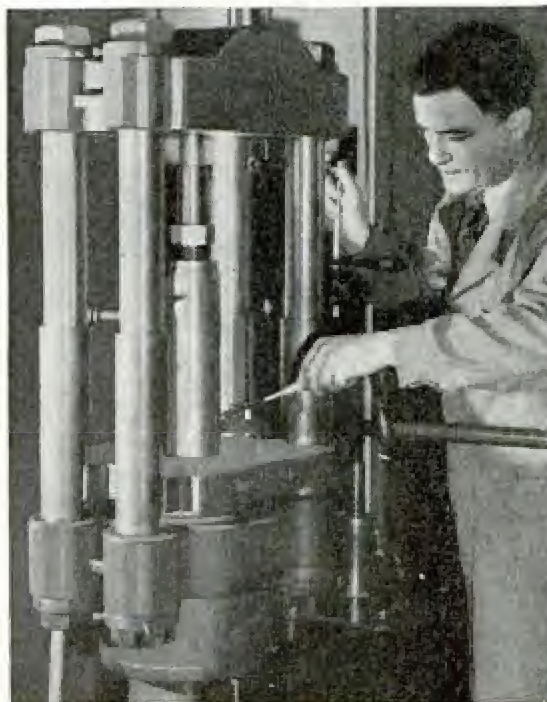
it's a scientific short cut for wearing things out. Plugs of a metal under test, for instance, are screwed into the bottom end of a bar that is caused by a magnetic field to vibrate longitudinally—that is, actually to get microscopically longer and shorter, at the rate of 8,000 vibrations per second.

The bar with its test metal rests in a vessel of liquid, and the ultra-high-speed vibration actually makes a hole in the water, leaving a vacuum where the rod withdraws and immediately slapping down again with a force such that 30 minutes on the machine equals months of actual wear.

The vibration is at such a rapid rate that it causes a shrill squeal, above the noise level of pain—about 115 decibels—and the unit is confined in a soundproof box while in operation.

In another laboratory, a scientist is peering into a Diesel engine that is actually in operation. He designed a tiny quartz window that resists the combustion pressure of about 1,200 pounds per square inch, and also avoids sooting. With an arrangement of mirrors and a spectroscope or high-speed camera, he deduces things about the efficiency of engine and fuel by studying the light from combustion.

By adaptation of pistons within pistons, hydraulic press builds up to 1,500,000 pounds per square inch



Visual thermometer—a gauge to measure the temperature of flame by matching color of fire with heated coil in 'scope

Elsewhere, polarized light is used to test, on plastic models, where stresses would occur on a piece of metal of similar shape. For example, a chain-hoist manufacturer may wish to know where his pulley hook is likely to break. The technicians can't photograph lines of stress through the metal hook, but they can photograph through an identical plastic hook, and the strain shows as lines of stress under polarized light.

Upstairs is an innocent-looking hydraulic press, capable by an adaptation of pistons within pistons of building up a pressure of one and one half million pounds per square inch. Down in the basement an operator is pouring buckshot through a balance to determine, by weight of the shot, just how much foundry cores will stand before they break.

In the new metals and minerals building they are really finding substitutes for common sand. The problem is to make more durable molds. In sand casting, the sand must be rammed in around the pattern for each casting, a tedious job. The alternative, making a metal casting, is too costly unless the same pattern is to be cast repeatedly.

Metallurgical crews are seeking an in-

(Continued to page 146)

Wells Office Furniture Co.
 410-12 S. Wacker Dr. Chicago, Ill.

7373 Typist's Wood Copyholder Has Fingertip Control



Fingertip pressure on lever keeps copy at eye level

Made entirely of wood to save critical materials, a wartime copyholder is said by manufacturers to compare favorably with the peacetime product. Noiseless in operation, the device always keeps the copy at eye level, reducing eyestrain and permitting faster work. Control is by a single lever, operated by fingertip pressure, and the copyholder is heavy enough not to require fastening. It can be instantly removed when use is served.

7-377 Pull Cord Releases Extinguisher From Tamperproof Box

To prevent tampering with wall-type fire extinguishers, and to provide immediate evidence in the event such tampering is attempted, a tightly sealed box is

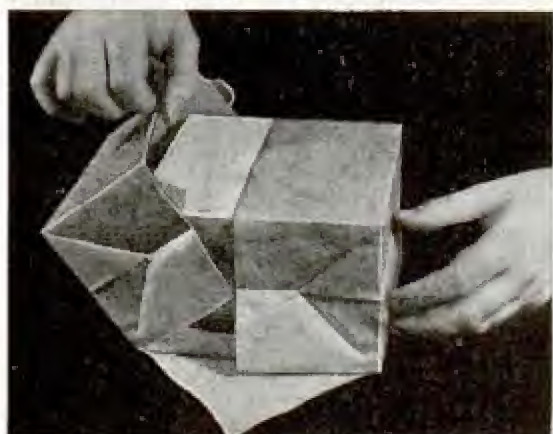
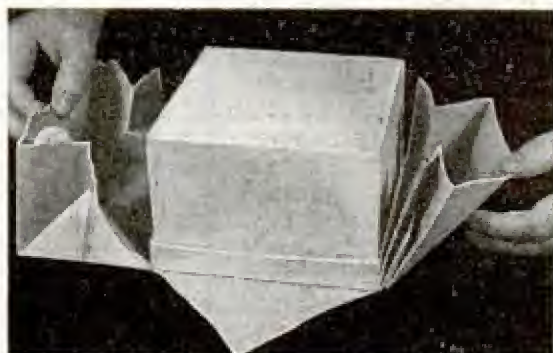


Pulling ripcord, right, exposes extinguisher for use

available, fitted with a string which when pulled, causes the case to fall apart and exposes the extinguisher, ready for use. The case, made of cardboard, can be resealed for further use. It comes in sizes to fit varying types of extinguishers.

77 3/3 Parcels Wrapped in 30 Seconds By Use of "Ready-Wrapps"

Pre-folded wrappings that fall into place over a box to be wrapped have been devised by Bill Y. James of Miami, Okla., who asserts they cut to one-tenth the time required for a gift package. Feature of the development, which Mr. James calls "Ready-Wrapps," is the folded sheet, so arranged that lifting one end allows the entire wrapping to fall into place around the parcel. The wrapper also bears



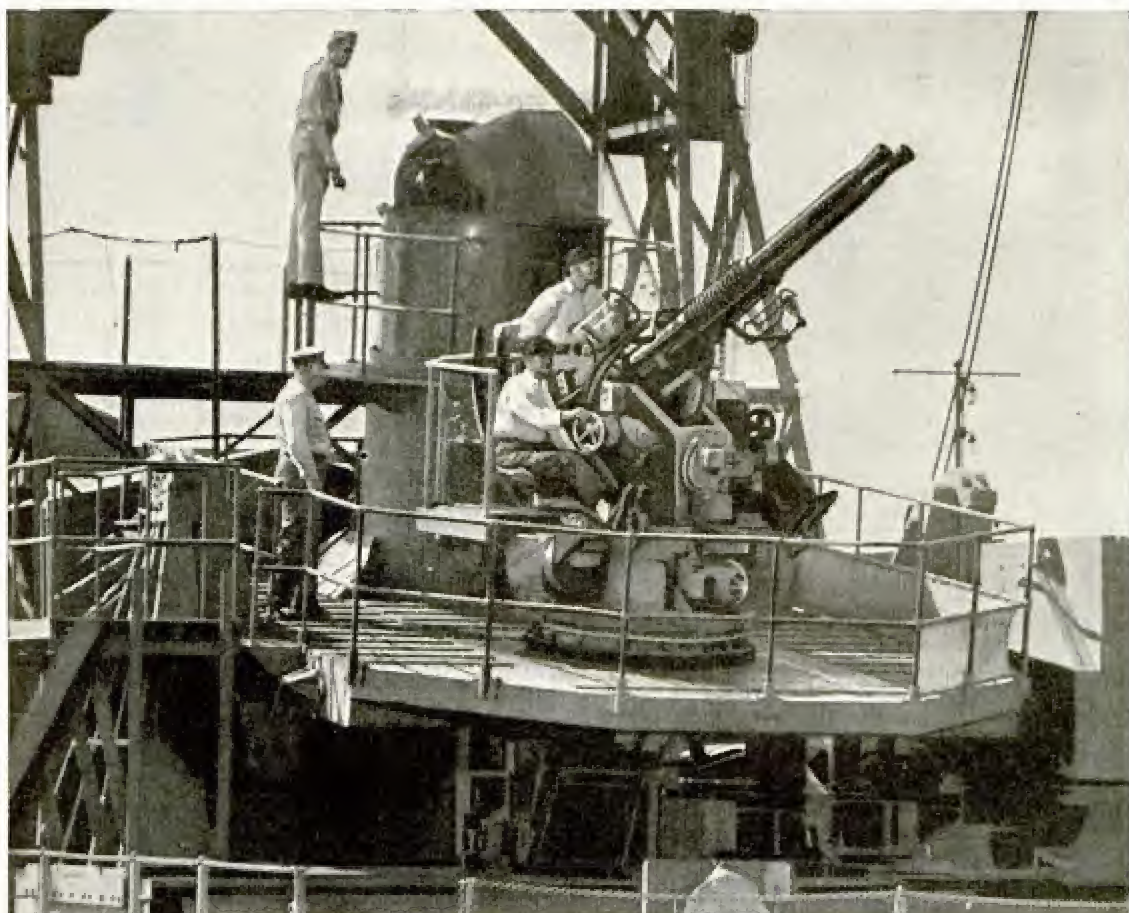
Unfolded, gummed wrapper falls in place around box

gummed tabs, which, when moistened before the operation, hold the wrapping in place. Ready-Wrapps are designed in three types, the shell type, which enables the wrapper to complete in 30 seconds a wrapping that once required five minutes; the sack type, that requires 45 seconds, and the envelope type, that requires one minute, according to the designer's estimates.

☐ In one minute's combat a flight of 50 fighter planes shoots seven tons of copper.

11321

Rocking Barge Tests Guns for Action on Ship



Navy anti-aircraft guns are tested on this rocking barge to determine how they will react to motion of ship

How anti-aircraft guns will operate on the high seas is determined in advance by mounting them on a rocking barge at the Naval Proving Ground at Dahlgren, Va.,

where ordnance and ammunition are constantly checked. Motion of the barge is an accurate rehearsal of the pitching and tossing of the gun mount aboard a warship.

Hammock for Jungle Fighters Defies Rain and Insect Pests

Jungle equipment for Uncle Sam's fighters includes a hammock equipped with a waterproof canopy, insect netting, and a

canvas bottom with a waterproof under-shell. Slide fasteners permit opening and closing the hammock from either inside or outside. Resting within the hammock, the jungle soldier is safe from winged pests, and out of reach of tropical snakes and other menaces from the ground. When not in use the hammock can be packed into a small bundle, and, being light of weight, is easily carried. It can be unpacked and made ready for use quickly, ropes being provided at each end for swinging the hammock between two trees.



Waterproof above and below, jungle hammock also has insect net. It is packed into a small, lightweight bundle

*Gen. Quatermaster Branch
Procurement Office
5th Ave., N. C.*



War material is packed for rough handling. Above, munitions on Guadalcanal. Below, tanks shipped from Fisher Body plant



UNCLE SAM PACKS & WALLOP

"AN ARMY," Napoleon mused, "travels on its stomach."

"A mechanized army," modern commanders amend, "travels on its spare parts."

Tanks without treads become mere gun emplacements. Planes with broken landing gear are nothing but sitting ducks. Even the amazing jeep couldn't go far with a broken axle.

For months it's been apparent that America's growing problem was not, "Can we produce enough," but rather, "Can we get it to the front lines in good condition after it's produced?"

"Getting thar fustest with the mostest" isn't going to win battles unless the supplies keep coming after you're there. And America's supply lines cross thousands of miles of enemy-contested ocean.

Yankee ingenuity, trusted right arm of American industry, is working on the problem of supply, too. One of its chief contributions has been in the variety of space-saving and cargo-saving methods developed to package and crate products of war.

They're putting mashed potatoes into paper boxes; wrapping airplane parts and even whole motors in cellophane; stowing grease away in fiberboard; shipping motor oil in lightweight bottles; tooth powder in paper cones; sand and asphalt in paper bags. The famous jeep occupies 190 cubic feet of space on the road, but it is stowed away in a crate that occupies—crate, jeep, spare parts and all—only 141 cubic feet.

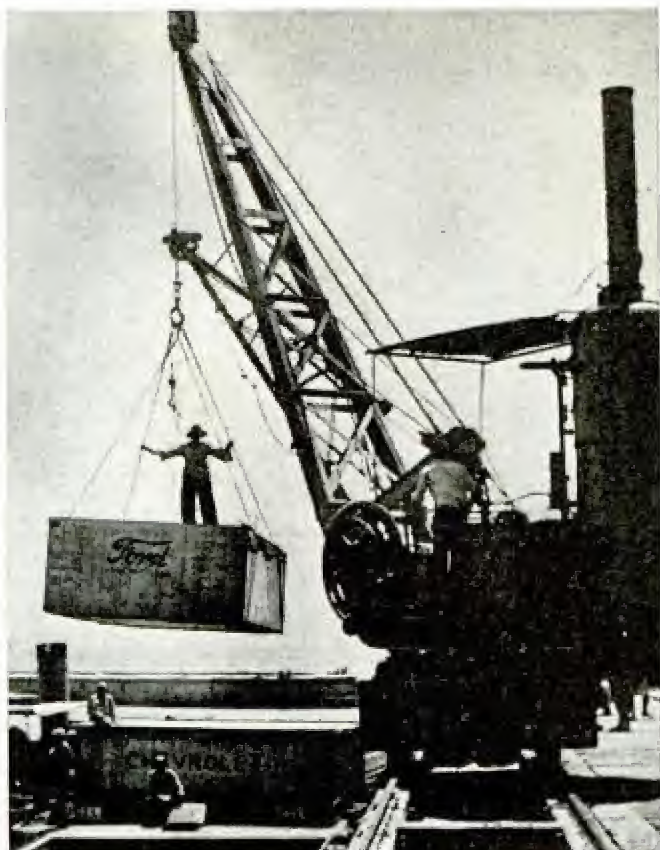
Consider the problem. That war plant in your town is making goods that may end up anywhere in the world. Its crates and cartons may be jarred about in a freight car, dropped from a crane, buried under tons of other goods in the hold of a ship, soaked in salt water when it is lightered ashore; baked in the blistering, sand-

gritty air of the desert or chilled in the brittle cold of the Arctic.

It may lie ignored for months, or it may be pounced upon by soldiers desperate for just what it contains. The package must protect its contents from all the hazards of weather and human carelessness, and still present the contents ready for use in the toughest of all wars. It can't be just good enough; it must be about perfect.

And it must be made of whatever materials are available, with due consideration for shortages and priorities. Further, with due attention to the fighting front, the home front still must not be ignored. Civilians still must be fed and clothed, and provided with a multitude of day-to-day needs, from toothpaste and shaving soap to shingles and shoes, and these also require packaging.

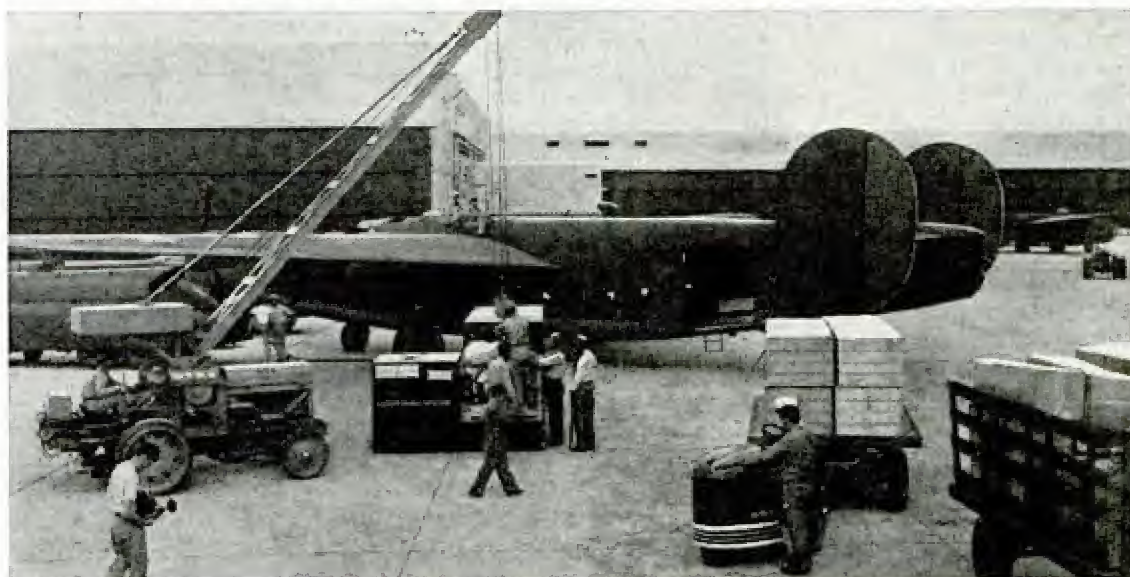
Typical of the studies of packaging methods occupying all industry is the experience of the Supply Branch of the Ordnance Tank-Automotive Center in Detroit, headed by Col. Paul G. Rutten. The center's concern is to keep America's mobile fighting equipment operating at thousands of miles from the factories. Last year \$500,000,000 worth of spare parts were made for army vehicles, and this year, with more vehicles, the need for spares will be greater. The center tries to outguess the Gremlins that inhabit freight cars and ships' holds and break these supplies or cover them with rust.



Cars and trucks from the U.S.A. are swung ashore at a Middle Eastern port. Crates must withstand rough usage; they get it

Primarily the part must be "protected from itself." Metal tends to sweat in certain climates, increasing the chance of corrosion. Parts leaving wintertime Detroit might go by a warm or cold route to California, there encounter another climate, and afterward pass through almost every type of climate the globe offers en route

With planes speeding material to distant fronts, packers must allow for high-altitude cold





Sometimes whole vehicles are merely swung aboard transports at the port of embarkation. Here a giant crane lifts big military truck

to Pacific fighting fronts. On a trip to Australia, the part, if unprotected, would be coated with moisture and dried again no less than 20 times.

Obviously, with metal that corrodes even from the moisture of a thumbprint, this soaking and drying must not happen. So each separate part is coated with a rust-proof, waterproof compound, wrapped and packaged in a wax-sealed container.

Identification is next. Soldiers unpacking a part must know what it is. Before the war, unaccounted tons of unidentified parts lay in service stations and army depots because no one knew, or remembered, their function. Such parts are good only for scrap. A medium tank has 41,000 separate parts, and few soldiers would identify all of them at a glance. The possibility of waste here, too, is great.

So the individual cartons are labeled with plain identification on six sides in weather-resistant ink.

Boxes have to be small enough and light enough to be handled without machinery, unless, of course, the part itself simply cannot be reduced in size. The reason is that many wartime ports have no dock, crane or lighter

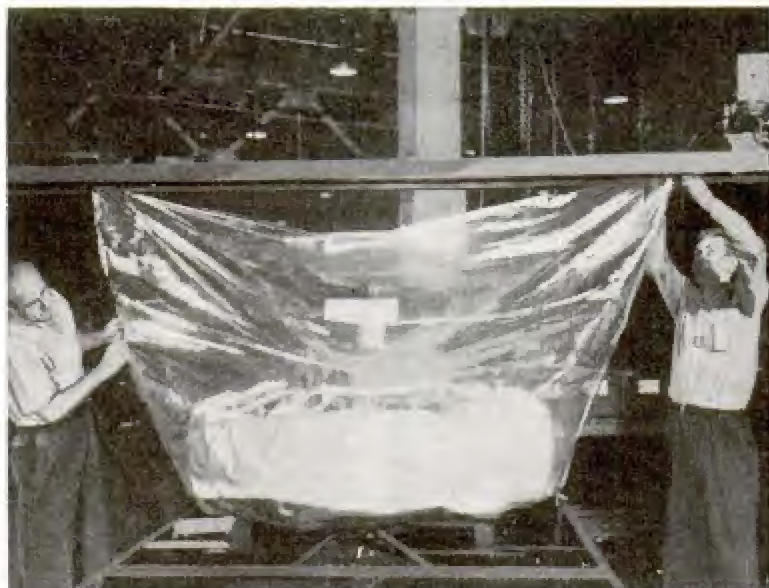
Aircraft engines are shipped in airtight, moistureproof pliofilm

facilities for unloading. Parts must also be elaborately safeguarded against dropping, bouncing, shifting and similar abuses by untrained personnel. Headhunters in New Guinea may be willing workmen but they can't be expected to get the significance of a printed, "Handle With Care." Some crates are swung off ships by block and tackle; some are even floated ashore. They are stacked up haphazardly sometimes — especially if the operation is under enemy fire.

Space also must be saved. One set of parts for 100 army vehicles—35,000 separate items—was packed first into 1,900 cubic feet of space. Engineers thought this wasn't bad, but kept trying to improve it. After the 13th trial they had reduced the space to 1,200 cubic feet—adding almost 50 percent to the amount of such cargo a ship could carry.

Replacement parts for the standard unit of 100 vehicles are placed in numbered boxes, arranged so that no part is buried, and supplied with a printed cross-index that permits anybody who can read to lay out the boxes in proper sequence, open the lids, and have a portable parts depot without unpacking anything. Emptied, the boxes may be used again to ship food, medical supplies, ammunition or the like.

Besides the printed identification on each separate carton inside the crate, the crate itself bears on the outside an identification tag tough enough to withstand every test



the engineers could impose on it; but for good measure they put another identification tag inside, so that technicians in the field won't be trying to fit a tank bogie on an anti-aircraft mount.

The Detroit experts thought they had their packing problem licked, but to make sure they took two boxes of parts with varying degrees of protection—some parts merely coated, some coated and wrapped, some coated, wrapped, packaged and crated—by train to the West Coast and dunked them for 14 days beneath the salt water of a remote inlet of San Francisco bay. Then they hauled the crates back to Detroit—115 pounds heavier for the soaking they received—and 10 days later opened them, with fear and trembling. The parts properly packaged were neither scratched, rusted nor marred.

"The test satisfies the Ordnance Department that present shipments of parts are reaching the armed forces in perfect condition," said Col. Rutten, to a rising crescendo of sighs of relief.

Chrysler Corporation executives who helped conduct the test foresee, with packaging of this sort, open-air warehouses, with no need for roofs or walls, only "acreage."

Fisher Body, shipping bomber subassemblies, has adapted steel-frame containers that were once used to ship automobile roofs, door panels and floors, to take the place of heavy and unwieldy wooden crates while still protecting the fragile airplane surfaces.

The metal frames can be used over and over again; the wooden crates used to represent only waste material, once the bomber parts were unpacked at the assembly point.

Willys-Overland is constantly at work saving space in the crates used to ship jeeps. The first occupied 168 cubic feet; the second 150, and the latest, only 141 cubic feet.

Wheels, windshield, steering wheel, bumperettes and body handles are removed and secured in the tonneau or under the body of the vehicle; a carton of replacement parts is placed inside, and the crate is

Jeep, spare parts and crate take less space than assembled jeep alone would



To test packing of replacement parts for army vehicles, box of the parts was sunk in San Francisco Bay. Here, workmen remove the box

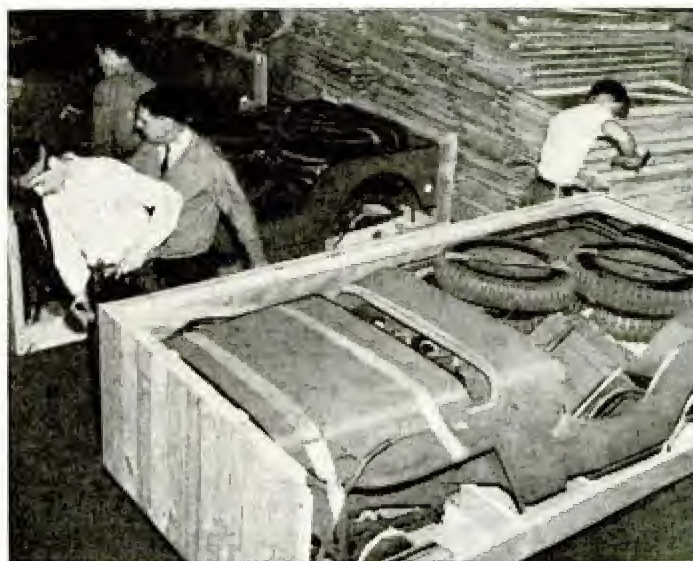
sprayed with tar and covered with moistureproof paper to protect it against sea air. Jeeps so packed can be "reassembled with a monkey wrench," in army lingo.

Metal containers, the familiar tin cans, safeguard everything from ammunition and food to "signal smears"—chemicals used by shipwrecked men to dye the surface of the sea as a signal to rescuing fliers.

Reynolds Metal Co. has produced "Renflex," a combination of paper, cellophane, asphalt and leadfoil to replace metal in protecting bandages, sulfa tablets, emergency lifeboat rations and dehydrated foods. Ohio Boxboard Company developed a paper container in which meats are cooked at temperatures as high as 350 degrees.

Adel Precision Products Corp. produces cellophane bags to package such plane replacement parts as anti-icing systems and

(Continued to page 148)



The Knowledge Corp., 1120 Madison St., Springfield, Va.

Domed Hoghead for Sentry Gives Comfort and Vision



Sentry sits in comfort and looks in any direction.

Sentries may keep comfortable and still keep an efficient watch in a shelter formed of a tobacco hoghead and a removable, transparent dome. The prefabricated sentry box is almost four feet in diameter and about 6 feet 9 inches high.

Rubber Stamps for Draftsman Halve Time on War Drawings

Use of rubber stamps in its drafting room enables an engineering firm to cut



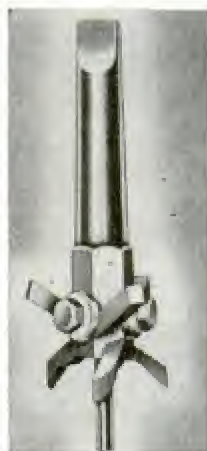
"Repeating" symbols of drawing are rubber stamped

44 *Lindberg Engineering Co., 2450 N. Michigan St., Chicago, Ill.*

the time spent on drawings to less than one half that previously spent. Such a procedure was found especially convenient for repetitive work, as in "drawing" wiring diagrams that used repeated symbols. Use of the stamp also is said to prevent errors and provide a neater imprint. One drawing that previously required eight hours' work is now completed in three.

Three-Blade Adjustable Cutter Makes Holes of Varied Width

Holes from $\frac{3}{4}$ inch to $4\frac{1}{2}$ inches in diameter may be made with a three-bladed hole cutter, whose blades are adjustable so that each set of three blades cuts holes of a variety of diameters. One trio of blades, especially recommended for electric drill and light drill press operation, for example, cuts holes from $\frac{3}{4}$ inch to $1\frac{1}{4}$ inches in diameter; a larger set, for heavy drill presses, cuts holes of diameters rang-

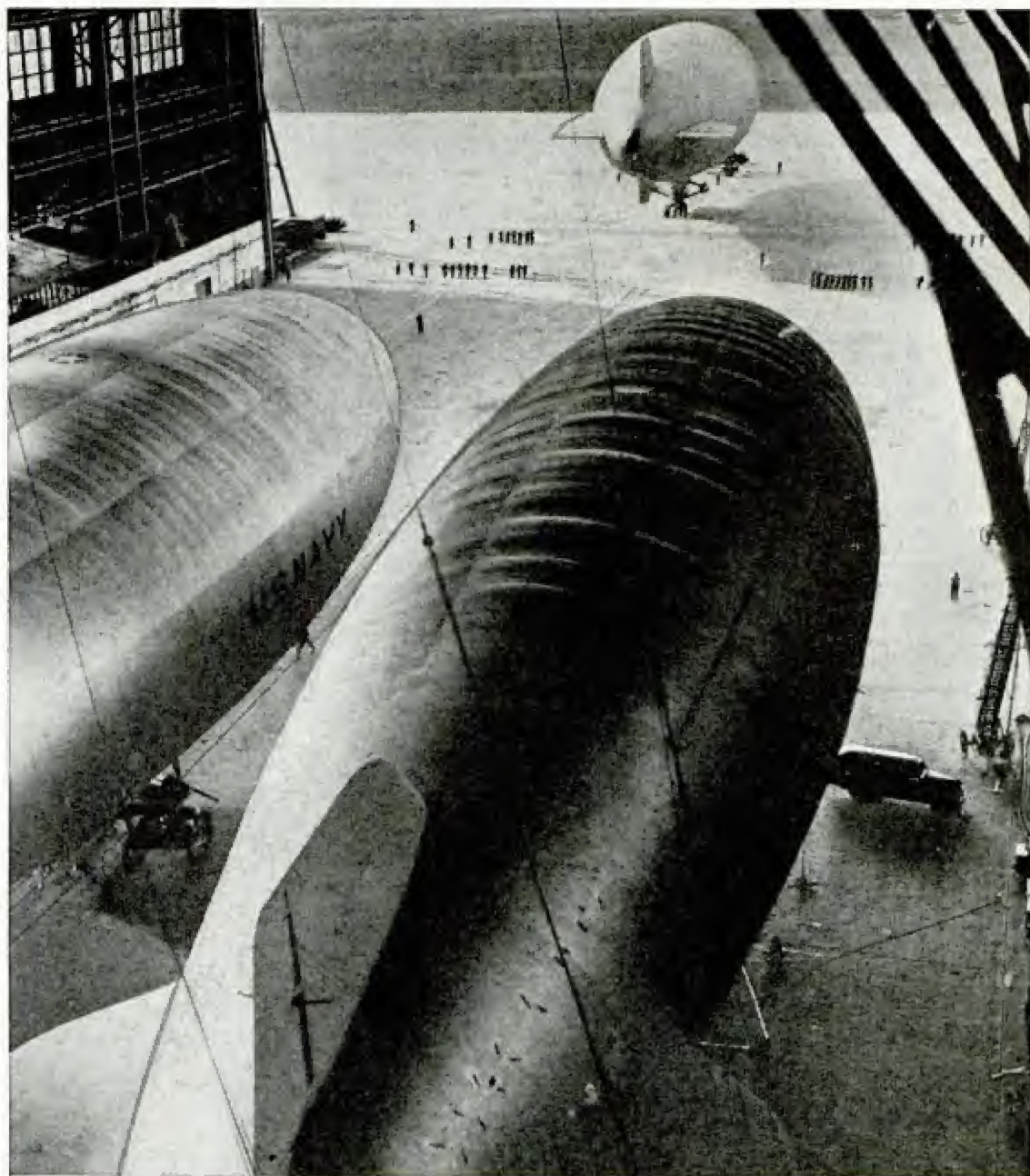


Cutter at work and, inset, three adjustable blades

ing from $2\frac{1}{2}$ to $4\frac{1}{2}$ inches. There are almost a dozen sets of varying size and for varying purposes. The blade may be set quickly to the diameter of the hole to be cut by measuring from the cutting edge to the pilot.

Write to the firms listed in the Where-to-Buy-It index, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

Blimps Poise for Flying Takeoff on Sub Quest M 1213



Two Navy blimps await their turn in hangar while another, dwarfing ground crew, is rolled out for takeoff

Lighter-than-air craft, which are playing a vital part in reducing the submarine death toll of merchant ships along the coasts, take off at dawn for patrol duty and return at dusk. Improved "K" type blimps manned by the Navy have a gas capacity of 400,000 cubic yards. They are equipped with a giant landing wheel which permits a flying takeoff, making it possible to lift a greater load than by gas capacity alone. After a ship is made ready for patrol, it is rolled out of its huge hangar onto a concrete apron while members of the ground

crew keep a firm grip on the anchor lines. Many of these craft—the number is a military secret—are based at the naval air station, Lakehurst, N. J. Portable mooring masts have made it unnecessary to build giant hangars all along the coast. Once the blimp required a trained ground crew of a hundred or more men to grab the landing ropes and bring the ship down. The latest blimps are equipped with air-filled "balloonets" which offset changing pressure and save the precious nonexplosive helium gas.

St. Andrew's, N.Y. 11 55 U.S. Navy
San Diego, Calif.

KITCHENS AFLOAT

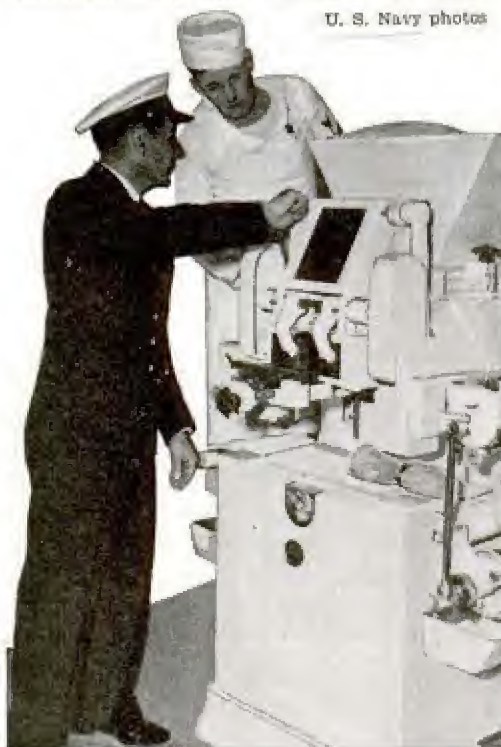
7/11



Feeding Uncle Sam's sailors is an epic job, because modern seafaring men aren't content with the traditional tinned beef and hardtack. They get tasty meals scientifically balanced. Sailors are fed at an average cost of 50 cents a day, a low figure possible because food is bought in huge quantities. Navy kitchens are compact, utilizing to best advantage the limited quarters aboard ship. Left, mammoth vats, polished to reflect like mirrors, are used to make soup, coffee, gravy and other liquid foods on mass-production basis.

Bread is baked fresh daily in the Navy, from the finest flour, eggs, milk and shortening. Once baked, loaves are stacked like cordwood waiting for hungry crewmen to demolish them

U. S. Navy photos



It takes a small army of cooks and bakers to feed a two-ocean navy. Chief petty officer, above, explains dough-mixer to student cook

Modern mechanical equipment for bread-making (right) is vital, for the U. S. Navy consumes 139,100,000 pounds of bread and flour a year





Sailors and marines keep their sense of humor even in the war zone. Aboard a carrier in the Pacific, the last T-bone steak is raffled off at 10 cents a chance, winner eat all

U. S. Navy photo



Pie-making machine above, operated by a seven-man baking team, multiplies production of one of the Navy's favorite desserts, turning out 900 pies an hour. Among the billion pounds of foods consumed by the Navy last year, 33,200,000 pounds were dried and canned fruits

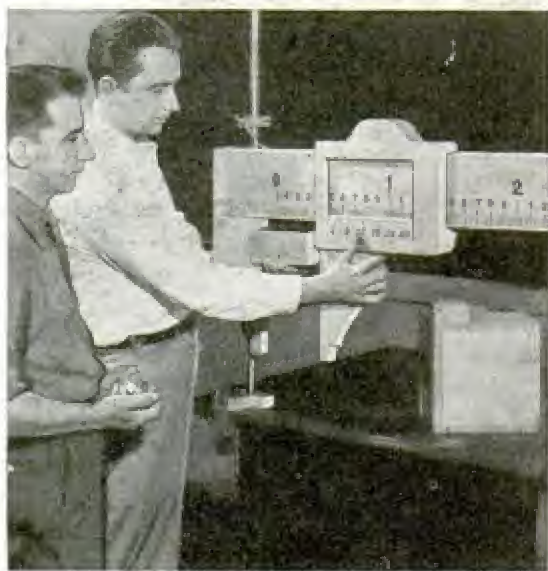


Apple pie is the favorite dessert of Uncle Sam's fighting Navy, with cherry, pumpkin, apricot and mince close contenders. The pies are big and thick (left) and are quartered to make man-sized servings. Besides automatic pie machines, Navy also uses automatic pan greasers

Navy food is so substantial recruits gain about 10 pounds during "boot" training. Last year Navy consumed 159,600,000 lbs. of fresh meat; 311,600,000 lbs. of fresh vegetables; 15,000,000 lbs. of butter; 19,700,000 doz. eggs; 62,700,000 lbs. of sugar, and 23,900,000 lbs. of cereals. Galleys aboard Uncle Sam's grim gray warships are run with all the skill and efficiency of big restaurants, with little waste



Giant Models of Instruments Teach Workers Their Use



Use of vernier calipers is explained by giant model

In war plants where it is necessary to give special training in the use of precision instruments to war workers unskilled in their application, large-scale models of the tools are an aid to the instructor. Thus one war plant uses a mammoth model of the vernier calipers to show quickly to individuals or groups how to measure with this important instrument.

Bolt Is Jarred Ten Billion Times To Test Grip of Nut

To test the shock resistance of their self-locking speed nuts, Tinnerman Products,



Nuts fastened to metal plates are given shock test

^{Ohio}
Inc., of Cleveland, developed a machine using an air hammer to vibrate a steel bar to which the nuts were fastened on metal plates. A hand screwdriver was used to tighten the bolts with a force that would be used in ordinary factory operations. The armature carrying the speed nuts was vibrated by the air cylinder at an amplitude of $\frac{1}{16}$ th of an inch, at frequencies of 3,500 cycles a minute or greater, and tests were run on the average of 35 hours, though some were conducted as long as 1,000 hours. The conclusions are that if you cannot jar a nut off a bolt after 3,000,000 sharp jolts, no amount of jarring will remove it—though many have withstood tests at as high as 10,800,000,000 vibrations.

"Spinner" Resets Thermometer By Centrifugal Force



Inertia of twisted knob whirls, resets thermometer

"Shaking down" a fever thermometer after a patient's temperature is taken is a tedious job, and may result in a broken instrument if it is carelessly struck against a wall or a piece of furniture. Mechanical resetting of such thermometers is accomplished by a knob clipped to the instrument. The knob is held in the left hand, while the case is turned clockwise a few times. The knob contains a resilient member that "stores" inertia, and when the case is released it is whirled instantly with sufficient centrifugal force to reset the fluid in the thermometer.

(To learn where to buy commercial products described in these pages, see the index.

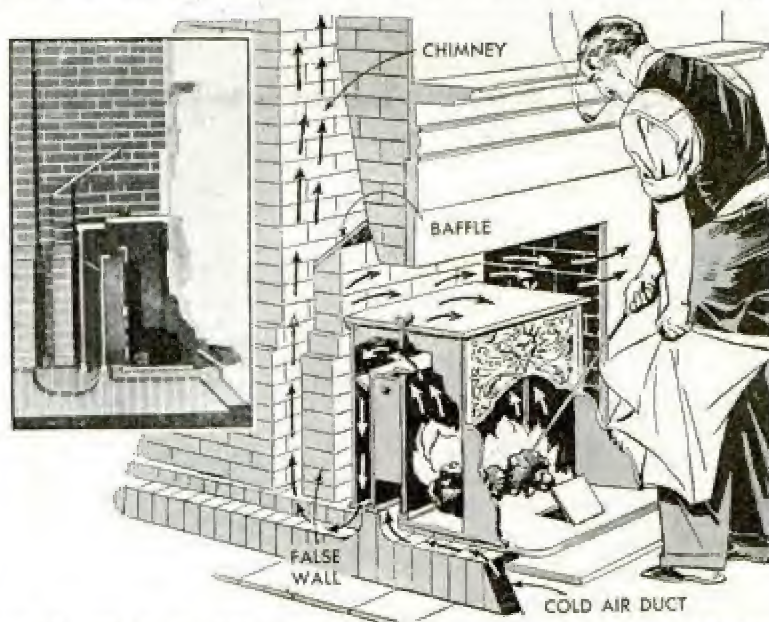
POPULAR MECHANICS

San Diego, California
W. J. Antone, Ill.

By: The Franklin Institute
Philadelphia, Pa.

Ben Franklin Stove Is Model for Fuel Economy 7159

Ben Franklin's first invention, a fireplace stove designed during the Revolutionary War period, has sprung into new prominence because of fuel shortages. "I love economy," Franklin said, and proved it in his "Pennsylvania fireplace," of which he said: "As very little heat is lost when this fireplace is used, much less wood will serve you, which is a considerable advantage where wood is dear." Now that fuel oil is "dear"—or rather rationed—Franklin's original invention has been reconstructed in replica at the Franklin Institute in Philadelphia, so that it may be studied as a model for heat conservation. Curators at the institute believe a study of the model may suggest ways to redesign other fireplaces to conserve heat. In principle, the Franklin stove, set into a conventional fireplace, employs a false wall and baffle plate to prevent heat from escaping up the chimney, while allowing smoke to escape.



Stove Franklin invented holds heat, lets smoke escape. Inset: Side view

It incorporated one of the first methods of "air-conditioning" a room, because it uses as a draft cold air brought through a duct from the basement or from outside the house. This air, heated, is thrown back into the room. The fireplace was reconstructed from Franklin's original drawings and actual specimens still in existence.

Outdoor Garage on Alaska Road Protects Against Wind 7132

Winter operations on the Alaska Road constantly present new service problems to motor mechanics responsible for keep-

ing traffic flowing. As a result of early experience, the high command of the highway has decided to build properly heated garages, but during its first winter the repairmen had to work at extreme temperatures either outdoors or in makeshift shelters, usually of tarpaulin and tar paper construction on a framework of lumber cut from nearby forests. Such shelters provided some protection from the wind, but none against the cold. Ramps of logs were frequently built, so that repairs could be made underneath vehicles. Even to change a tire a blowtorch was used on the rim bolts. In crossing glacier-fed streams, truckers generally found it necessary to thaw out their brake drums, which immediately froze. Tractors had to be thawed at bonfires to warm up the engines for starting.



Alaska road garage is a makeshift shelter of tar paper on a timber framework

SEPTEMBER, 1943

Cont: Mr. James Montague
417 Harbor Commission Bldg.
Toronto, Ontario, Canada

W. C. Cade's:

71 187

FEATHERWEIGHTS of the NAVY



"Six-bitters," the 75-foot Coast Guard cutters, dish it out on offshore patrol. Below, landing craft off Algiers puts ashore



HIGH on Uncle Sam's shopping list for the biggest navy the world ever saw was the notation: "A billion dollars worth of little stuff." That's what the old gentleman is getting.

More than 300 American firms—shipyards of course, but also paper factories, refrigerator and stove makers, lumber yards, railroad car builders—are turning out some 25,000 war craft under 200 feet in length. "Expendables" they called one class



Both Allied and enemy airmen who have made forced landings in the Channel owe their lives to the R.A.F. air-sea rescue service. Rescue launch approaches men in bomber's rubber dinghy

U. S. Coast Guard and U. S. Navy

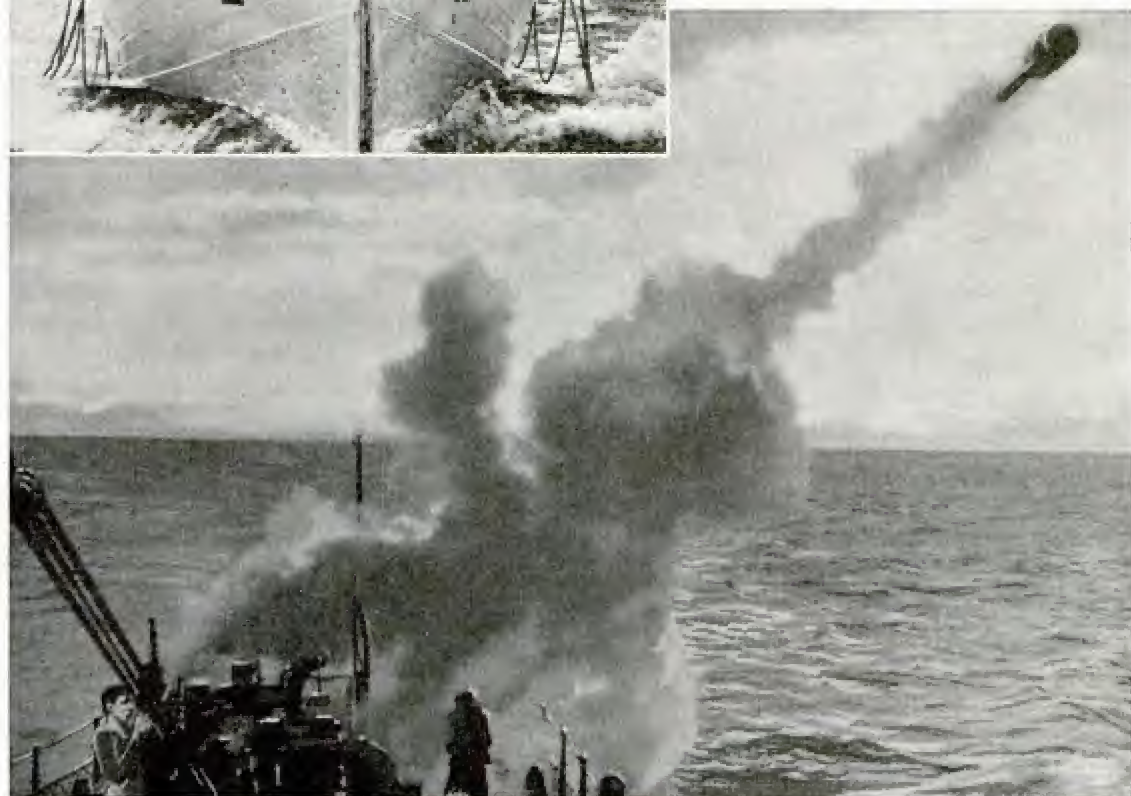
of these bantamweight battlers—the PT's; but the word for all of them is "indispensables."

For at sea as on land it's a technician's war, and it takes specialized machinery; picket boats, aircraft rescue boats, minesweepers, cutters, rearming boats, hospital boats, storm boats, buoy boats, net tenders, pontoon boats, amphibian tractors, dinghies, dories, lifeboats, target boats, launches, lighters—boats by the thousand to keep the offensive rolling and keep the enemy away.

The PT's grab the headlines by such stunts as sinking 250,000 tons of Jap shipping in one war year, and by ruining the time table of the "Tokyo Express," the shadowy destroyers that had almost nightly



Dressed for wintry blasts, Coast Guardsman of the Corsair Fleet shouts to a vessel on patrol (above). Left, lifeboats are self-bailing, self-righting nonsinkable. Below, depth charge from "Y" gun on Navy PC boat hurtles toward its underseas target





These Corsairs learn to "hand, reef and steer" as in Clipper ship days

reinforced the Jap garrison on Guadalcanal. They are the glamor boys, these 50-ton, 70-foot speedsters; the showpieces. One PT crew, seeing its first torpedo had been launched too far away to score a hit, poured on the fuel and actually outdistanced that torpedo—sped past it in getting closer to launch a second one.

But for most crews of the midget fleet, war means neither glamor nor glory, but grueling work, often aboard a deck that



PT boats above casts about in short, swift arcs protecting carrier against submarine attack. Below, hoisting out the float on a British minesweeper



leaps and pirouettes like an angry bronco and in quarters as cramped as a medieval cell. If they never see the human enemy, these sailors constantly battle a more ancient foe, the sea itself.

Some are pleasure craft, "inducted" for shore and anti-submarine patrol. Aboard one such craft, a yawl, nine Coast Guard seamen patrolling off New England were struck by a gale that pitched the vessel on its beam ends then dismasted her. With fuel tanks flooded, the auxiliary motor wouldn't work, and the stump-masted vessel was hounded by the storm for 21



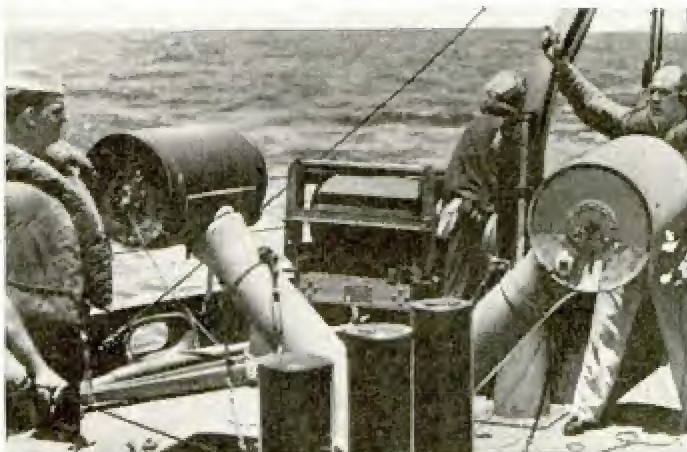
Above, launching "submarine poison," a destroyer-escort. Below, chief gunner's mate awaits order to fire "ashcans" at enemy sub

days, all the way down the coast from New England to the Carolinas before she was rescued.

"Corsair fleet" is what the Coast Guard dubs the sailors who practice old-fashioned seamanship to patrol the sub belt. As rough and ready are the crews of the 83-footers and the "Six-bitters," the 75-foot off-shore patrol craft. Both stay out and take it—and dish it out to the subs—when bigger craft make for port.

Thousands of pint-sized craft have but one destiny, to destroy submarines. Considering that

(Continued to page 150)



Sub-buster of the Coast Guard, this 83-foot patrol craft helps sweep American coasts clear of the submarine menace



Bomber Nose Test Chamber Duplicates Pressure Aloft



"Altitude" inside chamber is more than seven miles

Performance of aircraft and electronic equipment at simulated altitudes of seven and one-half miles is studied in a transparent plastic test chamber, shaped like the nose of a bombing plane, by engineers of the Radio Corporation of America. Aircraft equipment is sped to combat fronts by means of these ground-level "stratosphere flights," in which conditions of the upper air are introduced to determine how well the equipment will withstand them.

Quartz Rod Lights a Cigarette With Radiated Heat

Fused quartz, resembling glass, serves as a windproof cigarette lighter when one end

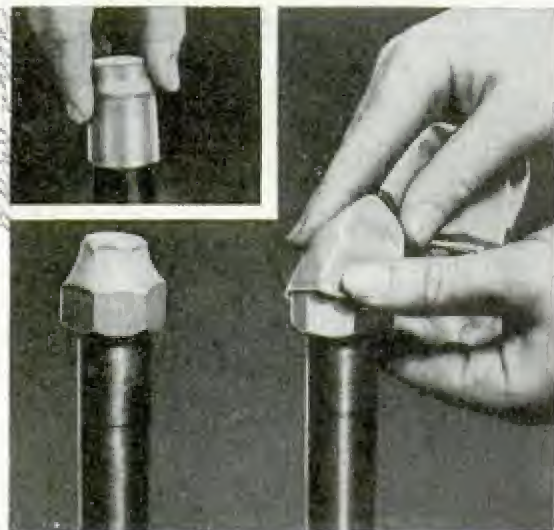


Holding the cool quartz rod while it radiates heat

of a rod made of this substance is poked into an opening in a furnace. The rod remains cool enough to be held comfortably in the hand while it radiates sufficient heat to light a cigarette, according to experiments conducted by P. K. Devers, General Electric engineer. Fused quartz transmits both light and heat with slight loss. Its possibilities have captivated the imagination of scientists for more than a century.

Cellulose Shrink-Tight Hoods Keep Plane Pipes Dirt-Free

Cellulose closures that are applied wet and shrink to make a tight seal are being used to guard the ends of fuel, hydraulic and vacuum lines that must be left disconnected in the construction of an airplane until time for final assembly. These "Cel-O-Seal" caps, as Du Pont, the manufacturer, calls them, have long been used to seal medicine and perfume bottles, as well as the ends of glass tubes in which toothbrushes are sold. In their new application,



Applying wet cellulose cap which dries to seal pipe

they keep rust and dirt from the disconnected pipes and tubes of airplanes, and also guard against possible sabotage, because tampering with the lines is impossible without breaking the cellulose seal. The caps are delivered to the user in a container of liquid, applied wet, and shrink dry within a few minutes. Caps used in plane manufacture are bright red, so that none will be overlooked and left in place during final assembly.

Names and addresses of makers or sellers of commercial products described in this magazine are listed in the Where-to-Buy-It index. Write to them for additional information and be sure to Say You Saw It in Popular Mechanics.



GOLDEN HARVEST of the SEA

AMERICA'S newest gold rush isn't in California, or in Alaska either. It's in the oceans surrounding the United States, the great lakes of the continent, the rivers and streams — even in the little ponds where any man can toss a hook and sinker.

Fishermen everywhere are gathering a golden harvest.

Recently a New York City trawler docked, her cargo was snapped up and each of the 10 men in her crew was paid off \$889 for eight days work, or more than \$111 a day.

The trawler "Cormorant" landed in Boston with \$27,000 worth of fish in her holds,



As in centuries past, Yankee fishermen, typified in statue above, are helping feed America in wartime



setting a new American record by \$6,000. This record was broken three days later when the trawler "William J. O'Brien" followed her in with 182,000 pounds of cod and haddock and her crew shared in the \$29,100 payoff. Other trawlers are doing nearly as well.

It isn't that they are catching more; the fish are worth more because of the scarcity of things to eat.

Seven billion pounds of fish would be about right for our fighters, our allies and our home tables in 1943. At the rate fish

are being hauled in, the U. S. crop will approximate only 3,650,000,000 pounds.

Scarcity of fishing vessels is one reason. In some areas the Navy took over half the fleets. Trawlers and draggers became mine layers and mine sweepers. Whalers became oil tankers. Cruisers became patrol craft.

Scarcity of men is another. The draft took many, and the Navy snapped up seafaring volunteers, too. High pay and bonuses in the early days of the war lured fishermen to freighters. Scarcity of engines and fishing gear proved another factor.



OWI photos

Gloucester fishermen stem from generations skilled in combatting the wiles of the sea. War adds its perils to the skipper above, and crews of Gloucester trawlers below



The navy is gradually returning the fishing craft, as the shipyards turn out new naval vessels; priorities are easing the equipment bottleneck, but the lack of men is likely to go on, even with the lure of high income.

For though the returns are good, fishing is not an easy money business. A fisherman needs the strength of a timberman, the patience of a tailor, the resistance of a fur trapper, and the endurance of a wrestler.

If he happens to have the courage of a marine, it won't hurt him any either, for German submarines are bagging fishing boats as fast as they can find them. During the early months of the war, the U-boats would pop up alongside a trawler and warn the crew to head their craft for home, or else. Now that the Nazis know how important fish has become to the American diet, they say it with shells, giving the men just time enough to get into dories and pull away from their doomed ship.

Efficient navy patrols are on the job night and day, with surface vessels and planes preying on the U-boats which prey on the fishing fleets which prey on the fish.

Even without wartime perils, the hazards of fishing are numerous enough with deadly cold, ravaging storms, icy decks and slippery ladders vying with the risk of infection from fish fins and fish knives.

Because the ships are inclined to work in groups, there has always been the hazard of collision, increased now, since lights must be doused because of subs. One such crash recently dumped 25 men into the sea off Boston, but fortunately all were saved.

Not so lucky were the men on the ill-fated "Mary E. O'Hara" which took 18 of her 23 crewmen down to a watery grave. Or the tiny "Frances," lost with all of her six men after being run down by a larger vessel. These are New England instances but the stories are similar wherever men brave the deep for fish.

During the first 300 years of fishing off the New England coast, more than 8,000 fishermen were buried where they worked—in the sea. Yet fishermen seldom change their occupation.

They tell true tales of the lethal swordfish, which strikes dories with express-train speed. One pierced a man's back with a jagged bony lance, killing him instantly as he sat on the bow thwart. Another, tangled in a fisherman's line, dragged him off, never to be seen again. Fishermen spin the yarns of disaster, but they keep on fishing.

There was the case of the crew whose cockle-shell boats ran into a school of angry swordfish which attacked them repeatedly, one boat being pierced four times in a single day and the others punctured so often that the trawler ran out of patching materials and had to substitute tin cans from the galley.

Or the battle with a 900-pound giant which repeatedly leaped 30 feet in the air when harpooned and finally, when almost exhausted, took a final fling with his sword at the fisherman, coming so close as to knock his cap into the sea.

Other more common perils are the chances of being washed overboard by mountainous waves or of being separated from a trawler in a dory.

Two halibut fishermen had the latter misfortune in a snowstorm off Newfoundland. One succumbed to the cold. The other, fearing he would lose his oars, permitted his hands to freeze tightly to them. He pulled the boat ashore and walked to the office of a doctor who amputated his fingers and thumbs.

But like all men who love the sea, this did not discourage him. He went into the fish business, made enough to buy a sailboat and piloted the little craft from Gloucester to Portugal—just for fun.

The crew of the Coast Guard Cutter "Cayuga" tell a story which illustrates the spirit of the



Rosefish, for food, fish meal and oil, are shoveled into hold for icing

fisherman. One wintry day they came upon a man rowing vigorously several hundred miles from shore. He had lost his trawler three days before in a fog. His first words were:

"It's about time you boys showed up."

Stimulants and medicine for exposure and fatigue were rushed to him, but he brushed them aside and demanded ham and eggs. Asked why he was rowing aimlessly in a deserted ocean, he said he liked to keep busy. Asked what he did when



Filled with tuna, 600-pound bucket swings over receiving trough
Fish and Wildlife Service photo



Trawler's lookout aloft to inspect fishing grounds

too tired to row he showed his scorn at such a foolish question.

"I fished, of course," he said. His lonely boat was half full of fish.

It takes such affection for seafaring to be a fisherman. While at sea, in a typical Atlantic trawler he works 12 hours a day—six on and six off—seven days a week. He faces gales and snow in the winter; fog and rain in the summer. He must step lively in heavy clothes, plus oilskins and

rubber boots. Most of the time he is being pounded by waves and spray. There is seldom a moment when his boat, whether trawler or dory, is not tossing or rolling.

But he eats the best of food prepared by the best of cooks and there is no limit to the number of "mug-ups," or between-meal snacks.

He won't work for wages in most cases, demanding and getting a share of the proceeds from the catch and changing from ship to ship according to his fancy. One boat, manned by a crew of 13, signed on 138 men for its trips over a year.

Not all men aboard a fishing boat are experts at all phases of the profession, but someone on each craft has to know more than how to bait a hook, or handle a net, or ice a fish.

A good skipper must know when he has a paying load aboard so he can decide whether to keep on fishing, or hurry ashore to catch a good price before other boats dump their fish on the market. He listens to market reports on a ship-to-shore telephone. Some actually can estimate tons of fish down to a matter of a few pounds and come pretty close to dividing the haul into varieties.

A good halibut man must know how to crack these fish on the nose with a killer club in just the right spot to end their thrashings. He learns that a 400-pound halibut is easier to dispatch than a livelier 80-pound one.

A mackerel lookout can locate a school of these finny creatures in pitch dark because they make the water glow with phosphorescence. In the daytime it is different, the schools showing black near the surface

Seining mullet on a California beach. Equipment priorities are easing one bottleneck that hampered fishermen



and red if submerged. Lookouts can even tell the size of the fish in the schools; large fish make coarse ripples.

A swordfisherman can locate his favorite prey in the tossing sea by the protruding eight inches of its triangular back fin and can distinguish it from a shark because the tail fin sticks up straight, while the shark's slants.

Others have to handle seines 1,500 feet long, maneuvering them so as to come up with a pay load, but not to overload the $2\frac{1}{4}$ -inch meshes, lest the net burst. The record for one set of seines is 130,000 pounds hauled in without breaking the nets.

But they can't pack the nets too full for Uncle Sam these days. With the active direction of one of the world's foremost authorities on fish, Dr. Ira N. Gabrielson of the Department of the Interior's Fish and Wildlife Service, Fisheries Coordinator Harold L. Ickes is cam-

Heavy nets slide down the side of a trawler, off New England



Harpoon stations on fishing boats operated by Coast Guard have given way to gun stations, above. Below, crew tending a net, 50 feet in diameter



paiging to furnish the industry with boats, equipment and men. At the same time the public is being taught that many varieties of fish which have been ground into fertilizer are good to eat. The British enjoy them.

Experts have always disagreed as to whether or not a shark will eat a man, but there is no doubt men will eat sharks and shark shops have already shown up in fish markets across the country. Thus 2,000,000 pounds have been added to the food supply.

Other species which you will get to know better as the war continues are the sea robins, which have birdlike wings, the angler fish, which has such a big head that he seems half mouth, alewives, which clog the fresh water streams during spring spawning, carp, which are really like overgrown goldfish, puffers, which swell up like balloons when you tickle their stomachs, but taste like chicken when cooked, ling, which spend

(Continued to page 154)

*San Juan Naval Training Station
San Juan, P. R.*

N 301

Sailors Learn to Row on Shore in "Land Boat"



*Chief Boatwain Mate
George Strobel*

Bluejackets in training at an eastern naval station make their maiden rowboat "voyage" in a 16-place, oar-equipped frame construction on dry land. By means of this preliminary training, the recruits are skilled in the timing that means real teamwork when they are finally sent out for the real thing—advanced instruction in one of the station's whaleboats.

Before bluejackets take a ride in whaleboats, they learn timing in land boat

N 356

Glass-Turreted Control Truck Guides Student Aviators

All aircraft, whether or not equipped with radio, can be guided to safe takeoffs and landings from the glassed-in turrets of control trucks developed by the Royal Canadian Air Force. Designed to aid student pilots landing at runways some distance from an airfield's central control tower, the mobile control turret can call warning by radio, or flash a warning light signal right into the cockpit with an Aldis lamp, in the event the student attempts to land without lowering his landing gear, or fails to give right-of-way to another plane. The

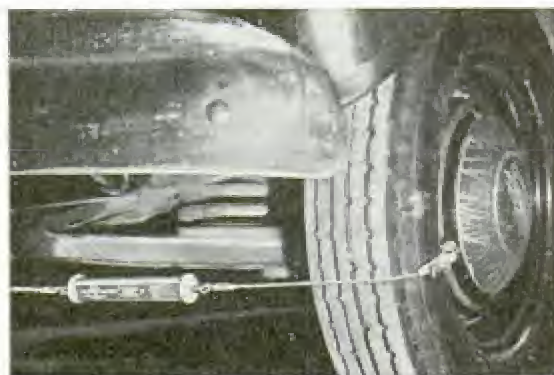


Turreted radio control truck guides student war pilots at remote runways

officer in the truck is also in constant radio communication with the central tower.

N 350

One-Man Toe-In Gauge for Tires Helps to Eliminate Excessive Wear

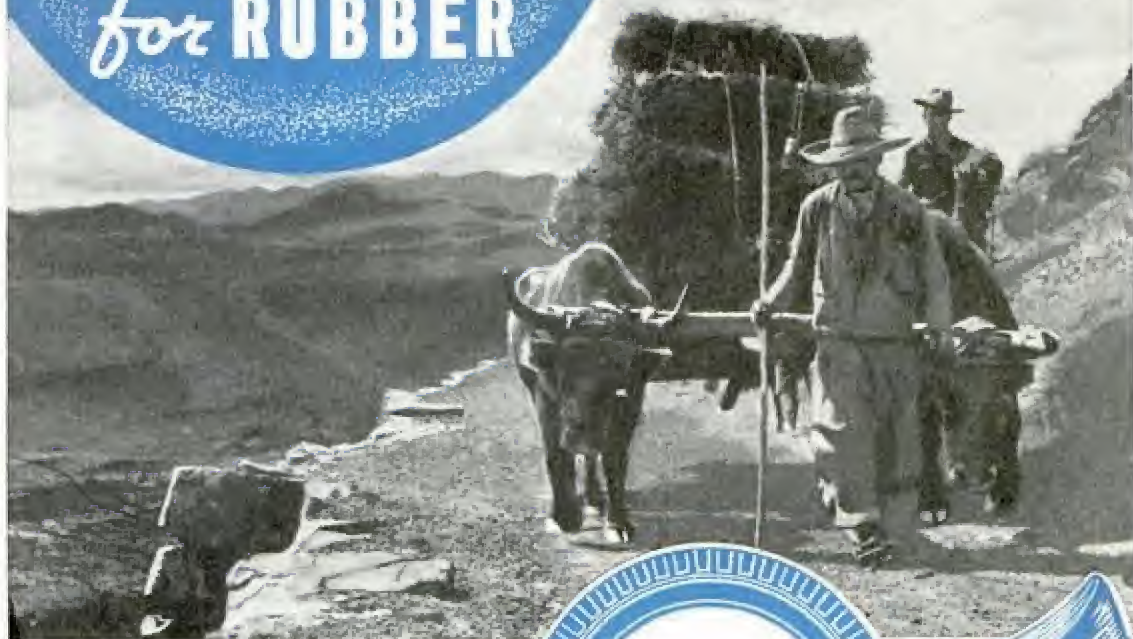


Measurement of the toe-in of automobile, truck or airplane tires may be made in a few minutes, and without the need of jacking up the vehicle, with a tiny gauge, resembling a hand scale. Proper amount of toe-in must be fixed to avoid excessive wearing away of the rubber. Grippers are attached to the rim of the wheels, and the vehicle is rolled forward to show the toe-in in inches. The gauge is light, measures 10 inches, and fits into a tool box.

With grippers in place, vehicle is rolled forward, and scale shows toe-in in inches

*Testing Apparatus, Inc.
1627 N. Fort St.
Detroit, Mich.*

The BATTLE for RUBBER



WE DON'T go to war entirely on shoelather and hobnails any longer, but neither is this mechanized melee all metallic. War tools that fly the skies, plow the deep or roll across the land enroute to conflict would shake themselves out of commission were it not for cushions of rubber.

So, while the average motorist is fretting because the old bus can't be driven to heart's content, the grim group directing the nation's war effort is watching, with fingers crossed, the desperate struggle of a huge army of men scattered throughout the jungles of three continents to get enough real rubber to the United States to eke out the thinning prewar stockpiles and the rising synthetic production.

Because the battle line of rubber is so widely scattered and so complex, the average person never gives it a thought. Yet it is changing the economic map of South America, North America and even Africa. One of the greatest mass migrations in history is taking place today in the valley of the Amazon River in South America, for example. It is spurred by the breath-taking urge to get rubber and to get it quickly. Planes, roads and boats that were constructed to move only precious metals from South American mines are now hauling more precious rubber.

Good neighbors
help U. S. find
rubber. Above,
hauling guayule
in Mexico. Be-
low, gathering
sap—Honduras





Baling guayule; man's muscles furnish much of the power in Mexico

Millions of acres of land in South America, Central America, the islands off their coasts, in Mexico and in our own southwest border states are being combed for or planted to the rubber tree, or the shrub, guayule, or the cryptostegia vine. In far-away Africa, the deadly Congo is being milked of rubber-tree sap. Right here, in our own New Jersey, Russia's miraculous rubber-yielding dandelion, kok-saghyz, is being harvested experimentally for its rubber content.

This battle for rubber, like the global war of explosives and steel, is being directed from Washington and New York, by government organizations like the Rubber Reserve Corporation, the Rubber Development Corporation and the Office of the Co-ordinator of Inter-American Affairs.

Officers in the field are experts from America and from the governments of rubber-producing countries. This army also has its planes, ships and boats; its medical corps; its quartermaster division to supply food and equipment, and its unsung thousands of soldiers who dare death in the green hades of the tropics, the miasmas of the swamps and the treacherous streams.

In the humid no man's land of the Amazon, rubber hunters are fighting jungle beasts, snakes, scorpions, blind worms, ants, wasps, poisonous larvae, spiney plants, sting rays, electric eels and even the rapacious onslaughts of piranhas, the cannibal fish. Amoebic dysentery, yaws, and yellow fever are ever present menaces, together with the world's most widespread disease—malaria.

They don't face enemy troops in their advances and marches, like uniformed sol-

diers, but they face death at every turn.

Disabled rubber tappers can't be taken to hospitals, so hospitals are taken to them, in the upper reaches of the Amazon. Two fleets of more than 50 floating dispensaries are being organized for Colombians and Brazilians who have volunteered to help the United States gather rubber.

Many of these will consist of a launch and a hospital with eight to ten beds, and all of them will cruise up and down the great green-banked river and its tributaries, picking up patients on the way, sometimes transferring them to hospitals being built at river settlements.

Because the hardy rubber tree flourished before Brazil cultivated it, and continues to

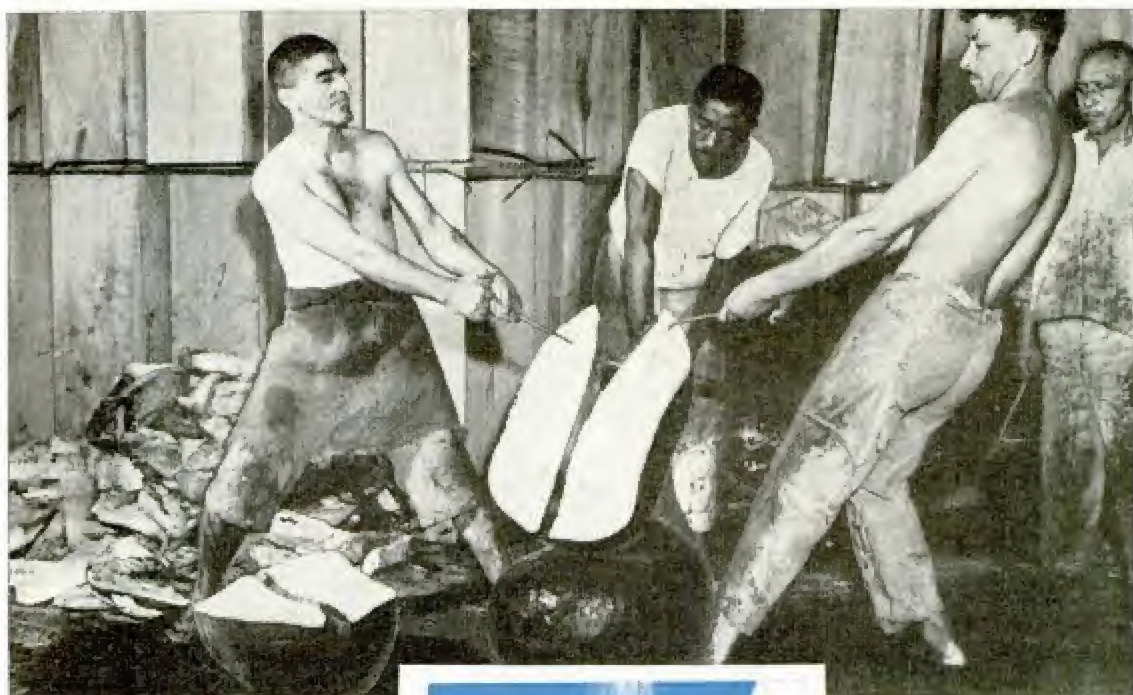
battle the other vegetation of the jungle to a standstill whether man aids it or not, this huge country is supplying the bulk of the rubber tappers, each of whom can obtain an average of a ton of virgin rubber a year and a good living—if they can bring themselves back alive.

Since we need at least 50,000 tons of Brazilian rubber this year, some 50,000 Brazilian workers have volunteered, some inspired by a doubling of the price of rubber to 45 cents a pound, and others by patriotism, since their nation is firmly on the side of the United States. Often with their families, they are moved 1,600 to 2,000 miles into the jungle where wild rubber trees thrive. Generally they go to the port of Manaus, which can be reached by sea-going ships although 1,000 miles up the Amazon. For the most part they walk the rest of the 600 to 1,000 miles to work, unless they happen to have donkeys or other beasts of burden.

While each tapper usually carries a shotgun and a machete, both handy in adding to his larder, he cannot subsist on game alone, nor can his family, so farms and food caches are being established to care for the diet of the army of jungle wanderers.

In Colombia's remote regions, at the headwaters of the Amazon river system, another army of rubber tappers has been mobilized in an area so isolated that an airplane service was established to fly the rubber to Bogota, the capital. A landing field was hewn from the forest by 30 men in 20 days.

Here, as in Bolivia, the river settlements provide scenes reminiscent of California's gold rush, with men being outfitted in the



primitive wooden stores, rushing for space aboard wood-burning steamers which drop them off at lonely points in the jungle where rubber grows raw in the famous Hevea trees.

Ecuador presented American experts with a novel problem. The peaceful Yumbo Indians had an estimated 1,500 tons of rubber on hand, and thousands of tons more available in a wilderness where they are practically the only potential labor. But this strange tribe didn't care to sell what they had nor to harvest more. They live in a practically workless paradise, being supported in most of their wants by the lavish "hanguara" palm.

Guns and machetes were the only available currency which would induce them to extend themselves, but they were well provided with these. Someone remembered the use of bright beads as payment and it aroused their attention. But the only beads they craved were red, white and blue fellows about the size of rabbit shot which they string and hang around their necks. The supply of these, which formerly came from Germany at a cost of 8 or 9



Workers in rubber warehouse at Manaas (above) on the Amazon, cut balls of rubber for grading, washing. Rubber is native to Brazilian wilds

Left: Bud-grafting produces high-yielding trees. A bud from registered tree is placed under the bark of a sapling
Ford Motor Co, photo

First step in transplanting of guayule (below) is to remove the tops of the seedlings
General Tire & Rubber Co, photo



cooperating with the United States, does not promise immediately to offset the war-time need for the 300,000 tons gobbled up annually by our factories—even with the help of synthetics.

So Uncle Sam's experts are pushing the quicker sources provided by two plants, cryptostegia and guayule, which yield just as good rubber, but at a higher cost.

In Haiti, our government has arranged for labor to chop down jungle areas for the planting of 100,000 acres of cryptostegia, a vine which grows to maturity in about a year, has few pests and which can be induced to "bleed" latex, like the Hevea tree, by cutting the stem every other day and training the vine over a bamboo trough to catch the liquid. This latex is coagulated in water, lifted out in sheets and smoked like Hevea latex. One man can care for an acre and the yield is about 200 pounds a year per acre. The "bleeding" does not injure the vine.

The United States Rubber Company has large plantings of the vine in Arizona and there are plantations in Mexico. The Department of Agriculture is conducting test cultivations in Florida, Texas, Arizona and California. Plantings are also under way in Cuba, Puerto Rico, Jamaica, Costa Rica and Honduras. It was brought to this continent from India in 1895 by a sea captain who gave it to a Mexican friend as an ornamental plant. It can be raised as a cash crop in any frost-free soil that will support a truck garden.

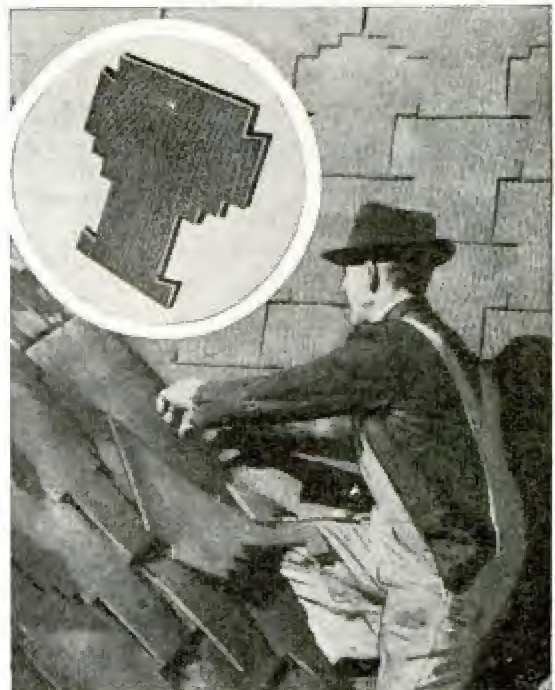
Mexico, which was second only to Brazil on this continent in Hevea tree rubber production during better times for the industry, is also coming to the rescue with its native shrub, guayule, which has always sent a trickle of good rubber to market. Mexicans are profiting by gathering the wild, as well as the cultivated plant, which is baled and sent to mills where the hardy growth is thoroughly crushed between stones to free the latex.

The Intercontinental Rubber Company and the General Tire and Rubber Company have fostered experiments in this rubber plant for several years, so that they were ready for expansion when the present shortage developed. A number of specially adapted agricultural implements have been developed by these companies to replace the crude methods formerly used, so the value of their huge plantings in Mexico and California is rising.

With all of these forces pulling together, if the final bottleneck of United States arms production should be found to have a rubber stopper, the chances are that Uncle Sam, his southern neighbors and the progressive corporations of the nation will smash it, stopper and all.

*The American...
500-5th Ave.
N. Y., N. Y. 7257*

Armored Shingles Interlock To Defy Wind's Force



Shingles are fireproof and interlock at four points

Roofing shingles are now "armored" to prevent their slipping apart or blowing off in the wind. Besides being fastened by four concealed nails, the shingles are designed to interlock at four points with adjacent shingles. The locking principle, integral to the design, requires no wires, clips or other fasteners. The shingles are finished to simulate wood grain.

7 424

"Vest-Pocket" Postwar Autos To Burn Aviation Gasoline

Pint-sized family automobiles that will burn aviation gasoline are predicted for postwar development by Dr. C. M. Larson, chief consulting engineer of the Sinclair Refining Company, member of the Society of Automotive Engineers. The high-octane gasolines which will be the regular fare of the postwar car are now available only for military aircraft and motorized equipment. The manufacture of high-octane gasolines will be accompanied by a reduction in the quality of Diesel fuels, according to Dr. Larson. This will force engineers to design Diesel engines for marine, railroad, long distance and overseas air cargo, and construction service that will get the utmost out of the low grade fuels. Aviation gasolines and other essential war products are now being produced in petroleum refineries, he said, at the expense of the distillates from which Diesel fuels are made.

Mr. E. H. Miller, 1212 N. Dearborn St.
Chicago, Illinois 7-254



The 1943 BUCKET BRIGADE

Civilians are in "bucket brigades" helping save our forest resources from disastrous fires like this. Below, "smoke jumper's" rig frees him if chute snags on tree



FIGHTING forest fires and protecting America's vital wartime lumber supply now is largely a volunteer, civilian responsibility.

Throughout the country, private citizens—men and women, old and young—have been organized by the thousands to form the bulk and backbone of an army faced with the gigantic task of preventing and controlling the always present fire menace in great areas of timberland from coast to coast which supply billions of feet of lumber for ships, docks, planes, cantonments, and all other war and civilian needs.

Even in peacetime, there were some 200,000 separate forest fires every year, and resulting losses were one of the heaviest drains on America's natural resources.

Now, in wartime, the danger has been magnified by possibilities of incendiary damage and bombing, the former already having been suspected of causing conflagrations on coastal areas. Moreover, any single forest fire is more costly than ever, not only because the damaged timber is more valuable but because the blaze may threaten military and industrial establishments. And huge smoke clouds from burning trees interfere with flying and pilot training, hamper such activities as anti-submarine patrols, and provide what might be an effective screen to mask an enemy attack by sea or air.

Before the manpower shortage became acute, fire fighting crews were available from many sources. Men and boys from the CCC were ready to help. There were



thousands of migratory workers. Saw mill crews pitched in, as often did soldiers and civilians when necessary.

Today, the picture is far different. The CCC is no more. The armed services and war industries have taken as high as 50 percent of the available manpower in some localities. There are fewer migratory workers—sometimes none at all. Soldiers are needed for combat maneuvers and training, and mill workers—those that are left—must be kept on the job if production is to be maintained.

Only the civilians remain to bear the brunt of forest fire fighting. Their numbers, too, have been depleted as far as able-bodied men are concerned. But so important is the fire fighting job that others have come forward to fill out the ranks of one of the largest civilian armies in the country. It is called the Forest Fire Fighters Service, and is one of the basic divisions of the Office of Civilian Defense.

Officially designated as the FFFS, this service is composed of anyone old enough or young enough to assist in any way to combat the forest

Forest Fire Fighters Service is a basic division of the Office of Civilian Defense. Above, a Mount Hood pumper-tank truck in action at a guard training camp. Below, a volunteer fire-fighting crew, equipped to hold the fire line in Wisconsin, is given last-minute instructions





U. S. Forest Service photos

Fire fighters afield are directed by portable radio

fire hazard. Practically all members of the FFFS are volunteers and are local residents. They have been organized into local and state groups, trained in fire fighting techniques, and are important cogs in the nation's defense machinery, the same as air raid wardens, watchers, and any of the millions of other OCD volunteers who act in capacities ranging all the way from auxiliary policemen to baby tenders.

Progress in organizing the FFFS has been consistent and rapid ever since the service was organized less than a year ago, and most states now have trained groups familiar with all phases of forest fire fighting. Under the leadership of David P. Godwin, national coordinator, the FFFS works in co-operation with all existing agencies having to do with controlling forest fires, including the Departments of Agriculture and Interior, state foresters, private protection associations, state and local defense councils and all police and fire authorities.

American citizens and friendly aliens are eligible for FFFS membership, subject to age and physical requirements set up locally. Two types of volunteers work under squad leaders selected by local co-ordinators. These are the fire fighters themselves—those who actually battle the flames—and the members of the service of supply, made up of cooks, telephone operators, messengers, timekeepers, waterboys—those who aid and supply the fighters.

Fire detection and patrol systems have been organized, and today in the nation's forests the armband of the FFFS, though new, is becoming everywhere familiar, even on remote pack trails and forest paths. This insignia is a red pine tree on the conventional OCD white triangle surrounded by a blue circle.

FFFS members are trained by experienced fire fighters and forest rangers, and are required to complete at least twelve hours of basic training. The course consists of lectures, demonstrations, the building of fire lines, and a general introduction to the tools, machines and techniques of fire control, which puts as much emphasis on preventing fires as extinguishing them. Training manuals are provided.

While the equipment of the FFFS is as modern and plentiful as it is possible to supply, a lack of critical



"Smoke jumpers" who land at remote areas to combat a blaze are the paratroops of fire-fighting volunteers

materials has made it impossible to put all the newest fire fighting tools in the hands of all local units. Civil Air Patrol and other planes, up-to-date radio sending and receiving apparatus, and facilities for dropping supplies and fire fighting materials by parachute are employed wherever possible.

In many instances, however, members of the Forest Fire Fighters Service are or-

ganized to operate in a manner quite similar to the old-fashioned bucket brigade, and this for reasons quite apart from lack of more equipment.

Says Mr. Godwin:

"The rural organization of the FFFS uses men and women from villages and farms, supervised and trained, of course, by experienced fire control men. But frequently they find it necessary to take action on small fires with little or no supervision. Consequently, it has been felt that they would be more effective using tools and equipment with which they are familiar, such as shovels, rakes, axes, hoes, fire swatters, simple pumps and other universally used implements. In using familiar tools, it is much easier to stress handling and the safety factor which is so necessary."

The original goal of the FFFS was 200,000, including women and boys. It is reported, however, that this number has been greatly exceeded. The work so far has been highly successful, not only in actual fire fighting

"Smoke jumper," right, is outfitted for heavy, hot work. Below, mopping up edge of a blaze



Towers, circled on dispatcher's map, report and help locate fire



and prevention but in making it unnecessary in many instances to stop logging operations and to shut down saw mills and war plants to provide fire fighters.

Since the FFFS fits in with and supplements already established organizations, the first thing the new recruits are taught is the type of group—Federal, state, county, town or private—with which they will work, and how it operates. Then, they are given the details of preconceived plans for forest fire control covering the area served by the FFFS unit to which they will be attached and how these plans operate in conjunction with plans in adjoining areas.

Next on the program is a study of a glossary of forest fire terms common to the local area, and of the usual causes of fires.

Approved methods and objectives of fire prevention, dangers and safety factors, methods of locating forest fires, systems of organizing action, fire behavior as affected by types of cover, by topography and by weather

(Continued to page 152)



W. H. Pitt, Salt Lake
million in air United Air 1939

Hydraulic Jack for Plane Tire Protects Rubber and Wheel



One-man hydraulic jack removes airplane's tire for inspection

To remove heavy airplane tires without damage to rubber or wheel, a hydraulic jack, activating a hooplike steel frame, is used by United Air Lines. Tires on a big transport plane take a drubbing every time they hit the runway, and require careful and frequent inspection to keep them at top operating efficiency.

Latest "Brew" for Rubber Taps New Raw Materials

Developed as a by-product of research on insulating materials by the Bell Telephone Laboratories, a new type of synthetic rubber is made of basic raw material hitherto unused in the manufacture of the No. 1 war shortage. The new product, called Paracon, can be used in gaskets, hose, for molding into intricate shapes, and to rubberize fabrics. Its heat resistance is said to be exceptional. Other tests for tensile strength, resistance to oil, gasoline, acids and steam compare favorably with other synthetic products. Aging in air and oxygen is equal to that of the Buna type rubbers, both

being superior to natural rubber. Paracon can be worked on ordinary rubber machinery and is expected to add to the present supply without interfering with present production plans. One company is producing Paracon on a semi-commercial scale in co-operation with Bell Laboratories and the War Production Board.

Zone Map Shows Shortcuts For Store Deliveries

By glancing at his homemade zone map, the proprietor of a Los Angeles typewriter shop saves gasoline and tires by routing deliveries and pickups without lost mileage. His store is in the center of the map with six zones fanning out from it, the zone boundaries based on a survey of distances to all streets. A movable arrow mounted at the store location is marked for eighth-mile distances, each mark bearing a different letter. Street intersections on the map are spotted with figures and a key book is used like a street manual. Thus the key to a certain location might read: intersection 34, zone 5, arrow mark B, or 34-5-B. The book gives the precise distance to the spot and is used in working out shortcuts. Tests on one of the company's delivery scooters showed map distances off only four miles in 1,500 miles of speedometer reading.



Homemade map with shop in center shows shortcuts at a glance

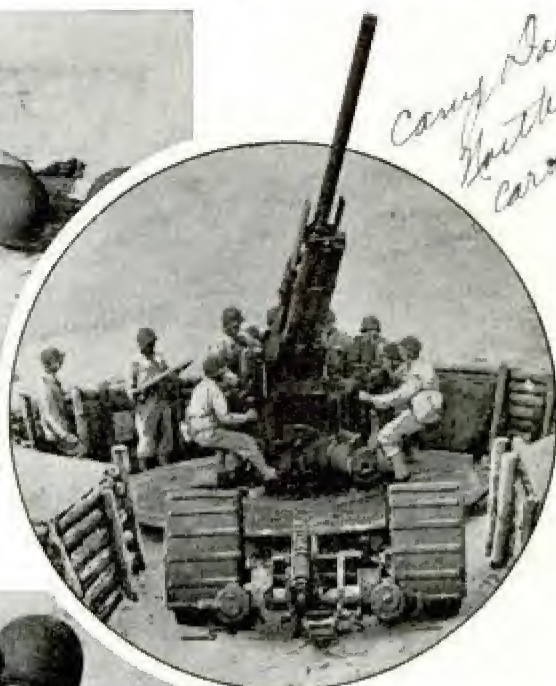
*Mr. Allen Warren Gilman
7 Clark Ave.
N. Y. N. Y.*

71 252

Teamwork by Gun Crews Wings Axis Warbirds



Stations of antiaircraft gun crew are dispersed to avoid presenting a single target to enemy strafers. Gun is aimed by remote control at director station



*Camp Davis,
North
Carolina*



Poised for action is the crew of 90 mm. gun above, bad news even for high-flying enemy planes. Ammunition carriers are moving toward the loader, and the gunner has his hand at trigger, waiting for order to fire. "Mechanical brains" do much of the work of estimating height, speed and direction of enemy plane, cutting fuse and pointing gun to precise point where its missile will hit attacker, though the gun may be aimed by hand

In battery commander's station, crew member operates the telescopelike viewer, reporting his findings to his captain, above. In the height-finder pit, right, the horizon and sky are scanned and target is located. The gun is then electrically aimed. On the right of mechanism here, elevation reader stands alone; opposite him stand, left to right, the azimuth setter, the observer who moves the finder to precise position of the target, and the elevation setter. Upon the accuracy of this device and the director depends the accuracy of the fire. Stations are timber-walled, connected by dugouts

Signal Corps photos



FREE MEAT--COME *and* GET IT!



Game commissioners spotted these fighting bull moose from a plane, landed and sawed their horns free

By Roderick M. Grant

WHEN your great grandfather got hungry, he went out and shot a deer or a duck or tossed a line to the nearest pickerel. He never heard of such a thing as buying corned beef for so many points out of a ration book.

Of course your great grandfather and his descendants were responsible for slaughtering our buffalo virtually to the point of extinction and reducing our waterfowl

population in 35 years from 140,000,000 to 27,000,000 with shotguns, and by draining of marshes and crop cultivation.

Nevertheless, wild game is making a big comeback and the U. S. Fish and Wildlife Service is very busy advising the man with a gun or a net or a bamboo pole to go after his share of the country's free meat. Last year our hunters bagged, and presumably ate, some 598,241 deer and 33,761 elk, 46 million rabbits, half that many squirrels and quail, 15 million pheasants, 16,275,000 ducks and millions of other pieces de resistance adding up to 255,404,055 pounds of dressed game.

That is, perhaps, only a drop in a dinnerpail. But Albert M. Day, assistant director of the Fish and Wildlife Service, points out that every deer or pheasant or trout taken by a sportsman and eaten releases an equal amount of beef, pork, lamb or poultry for civilian or army consumption. Naturally there are legal limits. Study the game laws



Agents of U. S. Fish and Wildlife Service trap beaver, free them in an area where they are needed

*U.S. Dept. of Interior
Wildlife Service, etc.*

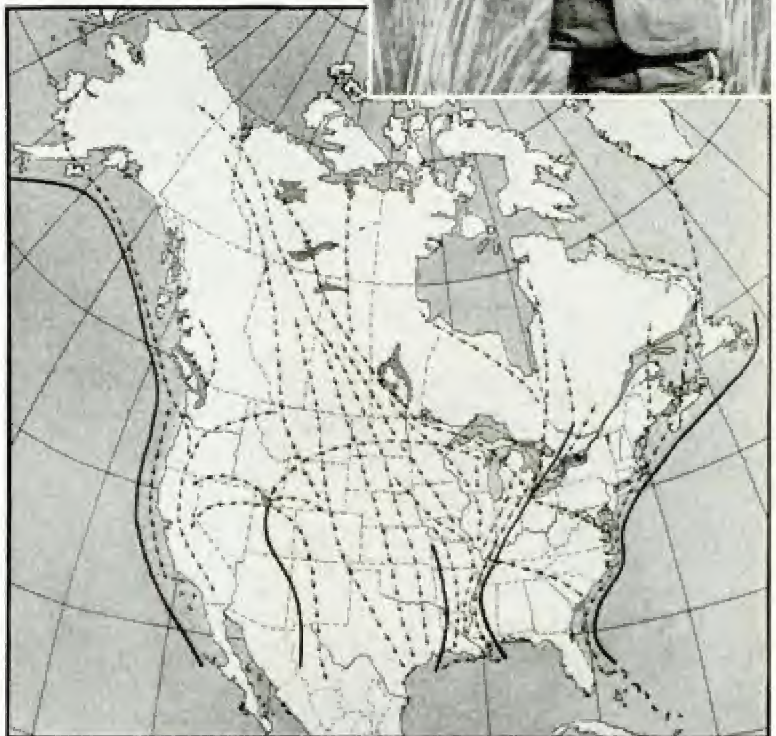


Photos from U. S. Fish & Wildlife Service

A bull seal talks over the fur situation with a Fish and Wildlife Service biologist on the Pribilof Islands. Just now the war is giving the seals a vacation. Right, releasing a black duck in Chesapeake Bay

and obey them. The government naturally will not permit any serious inroads into breeding stock, but there is little danger of that at the moment. The latest wildlife census, just completed, shows an increase of about 800,000 big game animals in the last two years, approximately a 10 percent gain. And the difficulties of wartime travel and the disappearance of ammunition, guns and tackle from sporting goods counters are bound to give the deer and ducks a bit of vacation.

The wild game harvest means all the more in a year when the "take" of our commercial fisheries will be seriously diminished. The tuna clippers are in the navy now. The salmon fishermen have been drafted. The oceans are not safe for the trawlers. From a catch of 4,900,000 pounds of commercial fish in 1941, the take this year will drop to an estimated 3,600,000 pounds. Virtually the entire pack of some species, such as salmon, is being taken by the government for military use or export. To offset this tremendous shrinkage in food, the Fish and Wildlife Service is encouraging the use of varieties formerly ignored. Menhaden, heretofore har-



Principal migration routes of our waterfowl are shown on map

Wildlife Service is determined that no more of our native game shall go the way of the heath hen and Labrador duck into extinction, and since 1937 it has conducted an annual inventory of fish, flesh and fowl which takes its experts far up to arctic Ellesmere Land and Baffin Island and to the breeding places of the Whistling Swan on Alaska's northern shores.

How the biologists and



A tank truck gives a load of salmon a lift toward their spawning grounds from the fish elevator on Columbia River



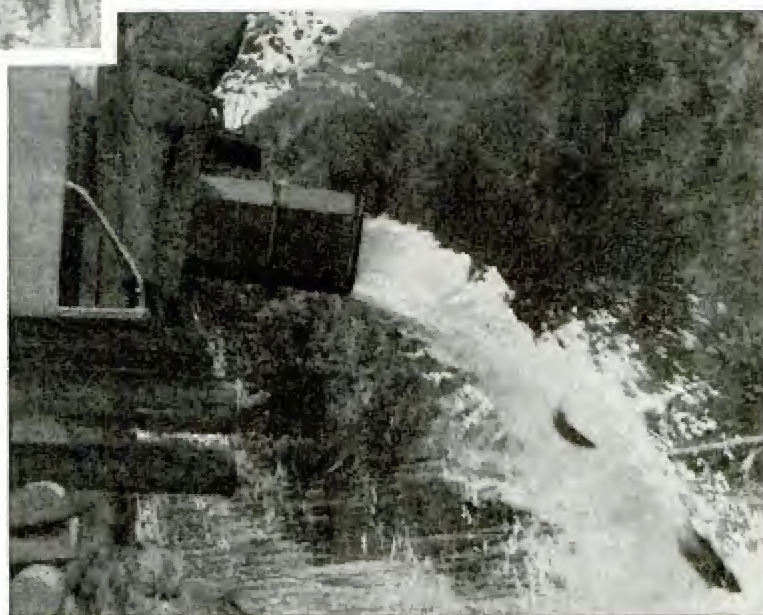
Climbing up to read the "Game Refuge" sign, a Virginia bear cub acquires a sense of security

their army of amateur collaborators arrive at their wildlife figures is a marvel of ingenuity and patience and mathematics. In peacetime, army and navy fliers, forest service men, a fleet of navy and coast guard ships, blimps and autogiros and bombers have aided in the inventory. Some game animals may

The fish truck opens its chute and salmon captured in traps at Grand Coulee find a new home

be enumerated by an actual count, or by count of a sample area, or by photographs of herds—such as elk—taken from an airplane; others are estimated by observation of nests, dens, and tracks.

One observer found a colony of cormorants nesting over one and one-half square miles in Lower California; figuring on one nest in every 100 square feet, based on a sample count, he concluded the colony contained the astonishing number of 348,480 nests. Such birds as pheasants, grouse and quail may be counted by marking off a 40-acre tract into strips and walking along the lines, counting the birds as they are flushed. Quail tracks in the snow, impressions left in the snow at roosting places, the whistling of quails in the early morning, the nuptial flights of the woodcock at dusk, all are used as indexes to the bird census. Rabbits have been tallied by driving an automobile along a route for a fixed period of time. Mountain sheep on Mt. McKinley, moose on Isle Royale and elk in the Jackson Hole of Wyoming





This bottlefed baby, "Big Medicine, Jr.," is an albino on the National Bison Range in Montana. Less than 5,000 bison survive

have been successfully enumerated from airplanes, but, unlike the elk, deer take cover in the woods and must be counted by census takers afoot. Last winter the Fish and Wildlife Service predicted a shortage of forage for elk and recommended a heavy kill to save the meat, but the advice was not followed in some areas and hundreds of elk starved in the severe winter. Some years ago the Kaibab National Forest became overpopulated with deer and, when wildlife lovers protested a planned slaugh-

ter, some 10,000 deer died of starvation.

Taking an accurate census of elusive wild animals would appear to be close to an impossibility. Nevertheless the Fish and Wildlife Service and State Game Commissions have reduced the inventory to a pretty exact calculation. The aerial roundup has become a routine technique, particularly in the west. Two days of flying back and forth across 5,000,000 acres of Wyoming resulted in a count of 5,000 antelope in winter herds, and the flying census takers incidentally discovered an unknown herd of 400 wild horses. The planes must fly below 500 feet, and not faster than 90 miles an hour. In deer counts, 150 to 200 men participate in a drive. Watchers stand along two sides of a giant triangle and tally the deer escaping as the line of men on the third side drives

toward the apex. Waterfowl have been estimated from the cab of a locomotive traveling along a river bank, and the kangaroo rat population of a southwestern desert was estimated by totaling the mounds on a sample area. These rats live alone, and the population over 50 square miles was put at 64,000. When you consider that each rat had stored away four pounds of feed, it constitutes something of a problem to livestock growers of the range who have thus been deprived of 128 tons of forage.

There's scarcely room for a takeoff among these crowded canvasbacks on Lake Merritt in California



The salmon climbing the fish ladders at Bonneville Dam are checked in as they cross a white plate in the river bed, and up in Alaska the government experts pace off 20 yards of a shallow stream and count the fish in that area, then get out the multiplication table for an estimate of the river's population.

The seal herd on the Pribilof Islands is a special ward of the Fish and Wildlife Service, unfortunately a war orphan at the moment. Since war came to the regions north of the Aleutians, the seals have been left to their own devices. In normal times census takers count noses from wooden towers overlooking the beaches where the bull seals and their wives and children spend the summer holidays.

Under U. S. management the seals are doing right well, thank you. Uncle Sam, having bought the Pribilofs along with Alaska from Russia in 1867, assumed guardianship of the herd and under the treaty of 1911 with Canada, Japan and Britain, the United States fixed the annual "take" and paid each of those governments the proceeds from 15 percent of the kill. Back in 1910 there were only 132,000 left in the herd. By wise management the herd, when last counted in 1941, had increased to 2,338,000. In that year the take was 95,013, and the average bull had a lot of deductions on his income tax blank, for his average harem comprised 64 cows and a nursery-full of pups.

We still owe the Japanese government for its 15 percent share of the '41 take, but it's a little uncertain whether they'll collect. In 1940 Japan gave notice of abrogation of the treaty on the alleged grounds that our seals were illegally dining on Japanese fish south of Kamchatka.

Right here in the continental United States, the inventory just completed shows a vast amount of live meat ready for the taking—subject, of course, to the legal limits. From a bottom of 27,000,000 in 1935, our waterfowl have increased beyond 100 million. The 1941-42 census of big game of 15 varieties totaled 6,748,000, of which white-tailed deer led with 3,805,000 (Pennsylvania has 750,000, Michigan 734,200, and Wisconsin, Minnesota, New York, Texas and Maine all run into six figures); mule deer 1,887,000 (Colorado has 398,375, California 325,428); Columbian black-tailed deer 396,075; elk 236,787 (Wyoming has 65,125); pronghorned antelope 199,385 (New Mexico 30,335); black bear 117,920 (California claims 17,970); peccary or javeline 54,120, mostly in Texas and Arkansas; mountain goat 16,395, exclusively in Washington, Montana and Idaho; moose 11,840, in which Wyoming (3,650), Montana and

(Continued to page 150)

\$60 Electric "Kiddie Car" Is Recharged Overnight



Levers control \$60 car's speed, brakes and steering

Speeds up to 18 miles an hour and maneuverability that allows her to drive right up to store counters is claimed by Mrs. Florence Detwiler of Fort Collins, Colo., for the electric car made for her by her husband, an electrician. Crippled by infantile paralysis, she is unable to walk. Speed and brake are controlled by a single left-hand lever, and steering by a lever rising from the single front wheel. Three heavy-duty batteries hooked up with an old Dodge N. E. starter give power to the machine, which can travel 20 miles on a single overnight charge. Total cost was \$60.

Glass Made Without Any Sand Superior for Optical Uses

Like baking apple pie without apples—that is one description of a formula for lens glass, which is made without any sand, the principal ingredient of ordinary glass. Because the sand is left out, superior cameras, spectacles and microscopes will be the result, Dr. E. D. Tillyer, research director of the American Optical Company, holds. Common chemicals making up the new glass include boric acid, zinc oxide or cadmium oxide, and aluminum hydroxide. Though glass made without sand is not new, such glass has not previously been reported suitable for optical use on a commercial basis.

*Mrs. Allen Warren Collier
7 Park Avenue, N. Y. C.*

11 180

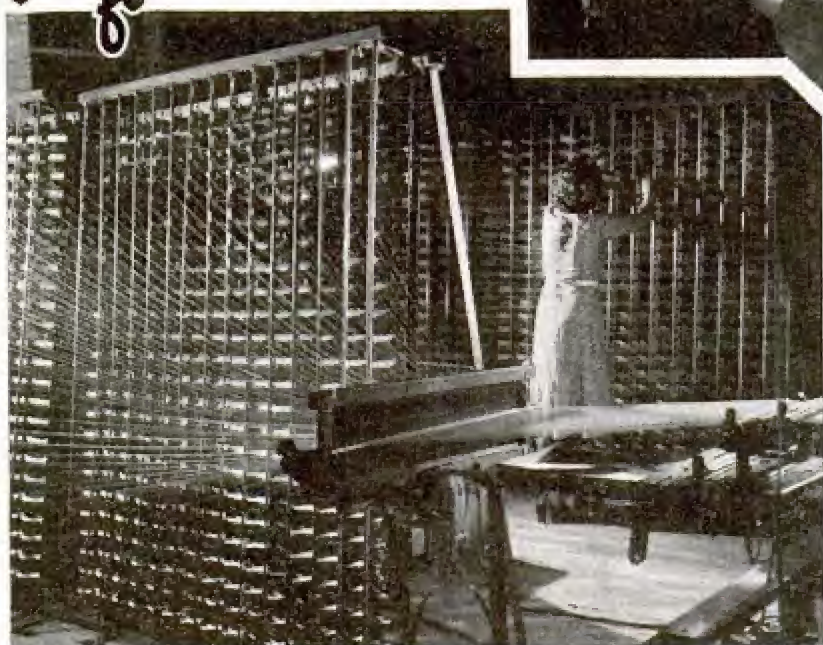


Modern parachutes are a far cry from the crude design of 15th-century Leonardo da Vinci, who first conceived of a device to enable man to float through the air. Along with the balloon, parachuting was developing two centuries ago, but the free-falling collapsible chutes are products of this generation. Chutes used by American paratroops (left) consist of the canopy, shroud lines, pilot chute, harness, and pack. The ripcord releases the pilot chute, and helps withdraw the canopy from its pack.

SILKEN WINGS for SUPERMEN



Mrs. Amelia Brooks



Sewing seams upon which soldier's life will depend is a task for such experts as the one above, shown assembling one of the big canopies

Left, a warping operation in the making of parachute cloth and shrouds. A thousand fine silk threads form the warp, a series of threads running the long way of the fabric. When one thread breaks, an automatic control stops the machinery at once



Constant inspection assures that every parachute is always perfect. Above, a chute is stretched over a table, under which electric lights glow, to show up any possible weakness or imperfection

"End product" of the labor and care of those who make parachutes is a soldier like the one at right, shock troop par excellence, an American paratrooper. He is poised in the open door of a speeding plane, ready to leap into nothingness, confident the canopy on his back will take him safely to earth



A certain percentage of all parachutes produced are dropped from planes, then picked up for inspection. Left, a number of canopies are double checked

Attaching shroud cords to parachute's straps is task of this worker, below. Shrouds are a sky soldier's lifelines
OWI photos



Cultivator Exhaust Fumes Kill Gophers and Moles



Cultivator's exhaust fumes kill gophers and moles

Though made from material that might have been assigned to a junk heap, the cultivator designed by John C. Burtner of Corvallis, Ore., has found a versatile career. Odds and ends of scrap metal form the cultivator's functioning parts, and it is powered by an old washing-machine gas engine. A metal flexible pipe connected with the exhaust carries the fumes into rodent holes to exterminate the pests, or drive them away. Equipped with a belt drive and friction "gear," the machine will pull light tools.

"Hose Horse" Has Adjustment To Direct Stream of Water

Victory gardeners or those wishing to water lawns are advised by its manufacturers that the "hose horse," a wooden



Stream is directed by adjusting leg of hose horse

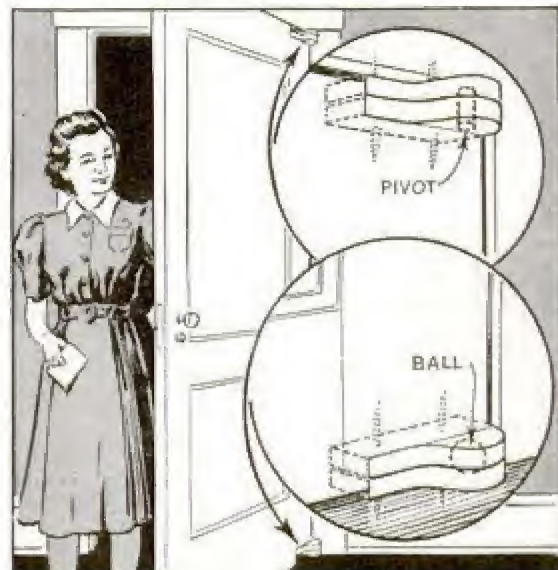
The Wood Products Co.
1127-12th St. N.W., Wash., D.C.
Milwaukee, Wis.

support resembling a construction gang's wooden horse, "stands up, sits down, and minds the bit." An adjustment of the rear leg makes it possible to direct the water from a hose, in either a stream or a spray, in the direction desired, while the hose is held securely. The hose horse holds any ordinary garden hose and any type nozzle.

"Filter" From Body's Own Cells Used to Prevent Sunburn

Use of a chemical recently found to be a constituent of the body cells in an ointment applied to the skin provides protection against sunburn at least twice as effective as any other practical method, it was reported in the Journal of Investigative Dermatology. Para-aminobenzoic acid, the cellular constituent, reacts strongly with the sun's ultraviolet rays in the narrow band of wavelengths known to cause sunburn. Use of the substance in the ointment causes the reactions between it and the sun's rays to take place outside the skin.

Squeakless Wooden Door Hinge Swings on a Glass Ball



Door's weight swings on glass ball of bottom hinge

Door hinges made of nonstrategic materials to save metal feature a pivot in the top hinge impregnated in hot paraffin to eliminate friction squeaks, and a glass ball in the bottom hinge, which carries the weight of the door and allows it to swing freely. Bureau of Standards tests, consisting of swinging such hinges 10,000 times, have proved them satisfactory, makers say.

(To learn where to buy commercial products described in these pages, see the index.

POPULAR MECHANICS
Whitehouse Research Bureau
101 Park Ave., N.Y.C.

71 160

Aircraft Makers Build Own Time-Saving Tools

71 44
General

Despite their high priority ratings, when pressed for time aviation manufacturers may devise time-saving tools of their own, such as the "home-made" ones used by Scott Aviation Co. at their New York plant. First is a "merry-go-round" work table that preheats high-pressure copper tubing for sweating on brass fittings. A flame from a bunsen burner is directed at the union of tubing and fitting mounted at eye-level on the turntable. This preheating cuts down the soldering time appreciably. A soft lead is used in conjunction with an acetylene torch and the solder is fed at the bottom of the tubing. Capillary action causes the solder to rise into the joint to form a seal capable of withstanding internal pressures of 3,000 pounds to the square inch. Second ingenious development is a jig used to bend quantities of copper tubing around a hardwood block or die. The tube is cut to length, and one



"Merry-go-round" work table, top, preheats copper tubing for sweating on brass fittings. Left, copper tube is bent on wood die

end is inserted in an anchor hole. A smooth pull on the roller forms the first bend, then the tubing is reversed, placed in another hole against a block of different shape, and another rolling action produces the finished shape. Such "home-made" tools relieve pressure on tool designers.

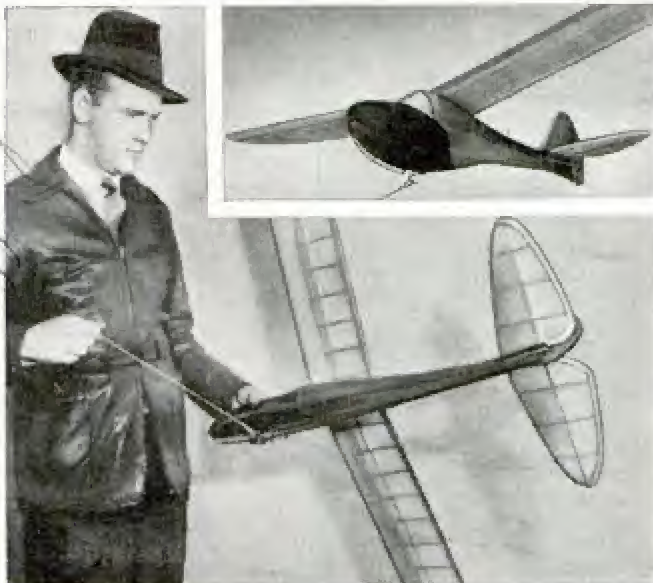
71 354

Model Glider's Towline Can Be Released When It Flies

To attain maximum altitude with a model glider without sacrificing its soaring abilities, a model with "tow-control" has been designed. With such control, also, it

is possible to maneuver the glider from the ground. Fitted with a ballast box for proper balance, the glider has movable control surfaces, connected with a control linkage arm, which in turn is maneuvered by a hook to which the towline is connected. In flying it, the operator sets it on the ground, and, running, pulls it into the air. During the take off, the tow control steers the model in a straight course. Once it is in the air, it may be maneuvered with the towline. For free soaring, once the model is vertically above the operator, releasing tension on the line makes the towline fall from the hook, allowing the glider to soar. Models have been successfully flown, the makers assert, using as much as 1,500 feet of towline.

Bill Offinger



Glider with "tow-control" shown in flight (top) has releasable towline to permit free soaring if desired

Berkley Models, Inc.
230 - Hudson St.
Brooklyn, N. Y.

Mr. Whittaker

71 240



Photos courtesy U. S. Military Academy

Reminiscent of peacetime is this familiar scene at the U. S. Military Academy, West Point, N. Y., for the Cadet Corps today is too busy with wartime duties to hold full dress parades

By Wayne Whittaker

THE parade ground at West Point is deserted. The full dress uniforms repose on hangers in cadet barracks and the plumed headgear—dubbed “tarbucket”—is packed away on a shelf.

But from the wooded hills that surround the historic and beautiful point high above the Hudson River come the rumble of field

artillery and the staccato bark of machine guns. Thousands of feet above the gray stone towers of the academy buildings is the silver flash of training planes flying in formation, their wing tips almost touching.

Here at the United States Military Academy some 2,400 young warriors are learning to lead men and win battles with the latest implements of modern warfare. They are learning to drive tanks and tank destroyers, how to cross rivers in assault boats under fire, how to operate antiaircraft guns and big 155-mm. field pieces, how to bury mines and build barricades of barbed wire, how to fly bombers and fighters.

The one word that describes wartime West Point is “rugged.” It is the word that is heard most often in mess hall, barracks and in the field. From plebe to first class—



Bayonet practice—a typical scene on the training fields



Cadet (above) using walkie-talkie during field maneuvers. Below, cadets advance through smoke screen on "front"



Over the top with bayonets—the men call this field work "rugged"

man and from "engineers" (top ranking cadets) to "goats" (pluggers), they are learning not only how to fight but how to uphold the academy motto of "Duty, Honor, Country." In this "college for generals" the cadets are trained to follow in the footsteps of such renowned graduates as Grant, Lee, Sherman, Pershing and MacArthur.

Since the United States entered the war the activities at the academy have almost doubled in tempo. This is due to an increase in enrollment of more than 600 men by authorization of Congress, to the transition from a four- to three-year course, to a completely revised and modernized military training course, and to the introduction of flying training. The result has been a 16-hour, rather than a nine-hour day for the cadets.

During normal times the four classes are composed of plebes (fourth classmen), yearlings (third classmen), second classmen, and first classmen (graduat-





When war came West Point quickly sprouted wings and here is part of the initial group of air cadets to complete training



On maneuvers with regular army unit, cadets (above) shoot it out with the "enemy" from an abandoned farmhouse. Below, with bayonets drawn the men charge, get taste of smoke and fire



ing class). Last year's first and second classmen bore the burden of the change to the three-year course. The first classmen were graduated in January—half of them with wings—and the second classmen received their commissions as second lieutenants in June. Until the war is over there will be only first classmen, third classmen and plebes at the academy. The first classmen are divided into two general groups, ground and air cadets.

"The program for the air cadets who received their wings in January is an example of the war tempo at the Point," says Maj. Gen. Francis B. Wilby, superintendent of the academy. "In order to spare the time for the necessary hours of advanced flying training this class took a concentrated one-month course covering academic subjects for the entire year. These included military history, economics, government, law, ordnance and some engineering."

In war as in peace, the cadets' working hours are divided between academic and military instruction from September to June. The summer months are devoted entirely to military training which includes field maneuvers for the entire corps. The summer training for all classes has been greatly expanded under the direction of Brig. Gen. Philip E. Gallagher, commandant of cadets who is in charge of all military training and discipline.

The plebes who entered the academy July 1—the traditional

"M" Day—are receiving the same basic training that a selectee gets during six weeks at an infantry replacement training center. Gen. Gallagher, incidentally, is one of the authors of the program now in effect at infantry replacement training centers throughout the nation.

Members of the third class who elect aviation are sent in April to fields conducted by the Army Air Forces for their primary training. They return to West Point in July and begin their basic training at Stewart Field, the "Wings of West Point," which is about 15 miles from the academy.

The development of Stewart Field, where the cadets receive both basic and advanced training, is one of the most dramatic stories of West Point at war. In fact, it is one of the outstanding achievements in the history of this 141-year-old institution.

Recognizing the vital part of the air force in modern war, Army officials determined at the outset of our entry into World War II that the world's greatest military academy should graduate officers directly into this arm of the service. That was in December, 1941. Eight months later Stewart Field was dedicated and the first class of 265 air cadets began their basic training. The field has been greatly expanded and when completed it will be larger than LaGuardia Field.

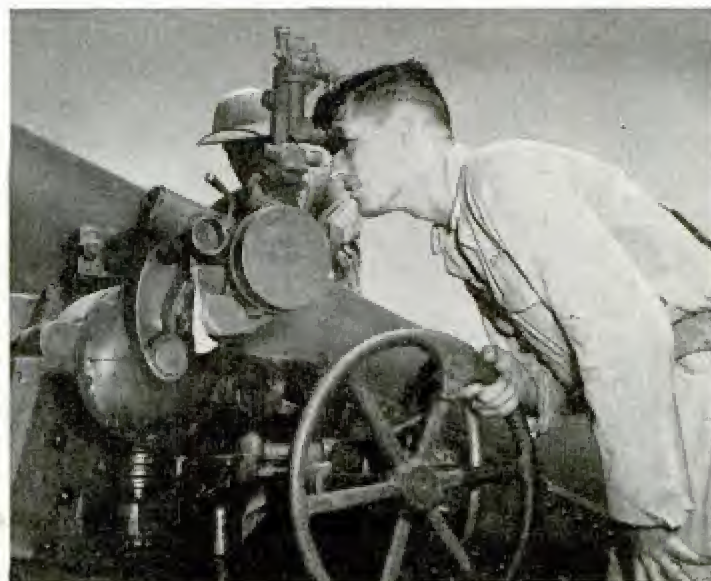
It takes a West Point cadet 13 months to earn his wings, several months longer than the average training period. This is because the men remain a regular part of the cadet corps while in training and their schedule also includes academic work. Gen. Wilby and Col. John M. Weikert, commanding officer of the field, think the additional time is well spent for the West Pointer who graduates into the Army Air Forces knows more than how to fly a plane. In three years of concentrated training he has learned the "big picture of war." He



Every cadet learns to operate weapons under simulated battle conditions. Here two man a machine gun from hideout. Note uniforms



Cadets ferrying army truck on pontoon raft. Their laboratory for amphibious warfare is Lake Popolopen at the Point. Below, aiming one of the heavy field artillery pieces on the academy's new range





With a heave and a ho cadets roll a heavy field piece into position to blast away at distant targets

knows how the infantry can best be supported by the artillery, how and where a protecting canopy of planes can do the most good. He is skilled in navigation, meteorology, aerial mapping, night gunnery, code and communications—but he is also trained to carry on the West Point tradition of fine soldiery and leadership.

The busy air cadet lives at the Point. Like other cadets, his day starts at 5:50 a.m. when the "Hell Cats," drum and bugle corps of enlisted soldiers, let loose with an awful cacophony of sound outside the barracks. The cadet arises, gets dressed, "polices" his room, and stands reveille at 6 o'clock. Breakfast is at 6:30 and by 7:30 he is on his way by bus to Stewart Field for flight instruction, ranging from simple formation to combat and instrument flying.

He leaves the field in time for noon formation at the Point, eats lunch and gets to class at 1 p.m. His classes may include

chemistry, modern languages, mathematics, history, military engineering, tactics, mechanics (including thermodynamics and fluid-dynamics), ordnance, military topography and graphics, theory of flight, and weather. After two hours of class, he may either get practical military instruction or an hour of physical training. At 6:20 he goes to the evening meal. After eating, he has 15 minutes that he can call his own. At 7:15 he is due in his quarters for two and three-quarter hours of study before 10 o'clock taps. Occasionally this routine is upset with a night flying schedule.

The spirit with which the air cadets take to their training is revealed by two signs they have put up outside one of the big hangars on the field: "To Berlin—3,121 Miles." "To Tokyo—8,117 Miles."

Aside from training pilots, the program at the field includes a 20-hour aerial observers' course for all third classmen during their summer training period.

The initial period of training for the newly arrived cadet is known as "Beast Barracks" and the upper classmen assigned as instructors are the "Beast Detail." The plebe receives instruction in dismounted and extended order drill, scouting and patrolling, field sanitation, tent pitching, rifle marksmanship, defense against gas, air and mechanized attack. He learns how to throw grenades and handle bayonets, how



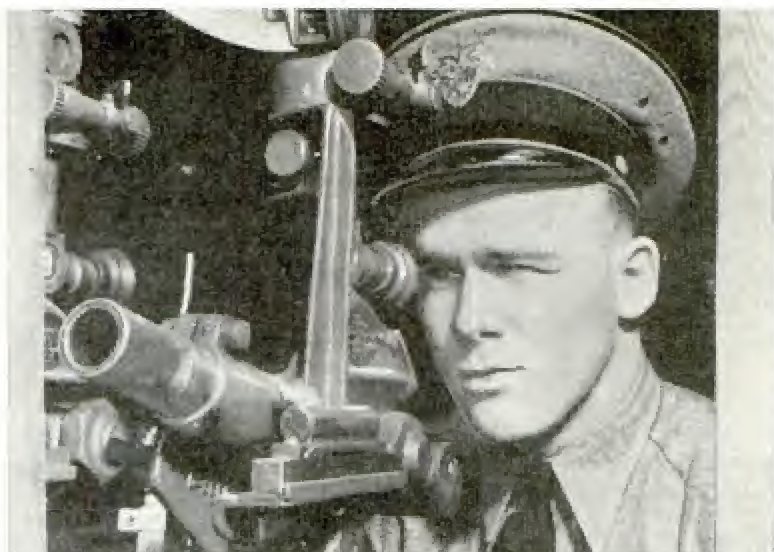
Carrying huge pontoon which will form section of bridge

to hike and take care of himself in the field. He also learns the regulations and customs of the military academy as outlined in a handbook called "Bugle Notes" which is better known as the "plebe's Bible." He is taught military discipline, "to do a thing, do it right, and be quick about it."

In mid-August the new cadets join the corps for field maneuvers. At the end of the summer, the fourth class is fully incorporated into the corps, consisting of two regiments and four battalions, and the new cadets are permanently assigned to companies of the cadet brigade.

Summer training for this year's third class (last year's plebes) includes marksmanship and field firing with rifles, light and heavy machine guns, carbines, mortars and antitank weapons. The third classmen are also instructed in antiaircraft firing with rifles and machine guns. Under regular army officers, they are trained in pioneer tactics, field artillery, the driving and maintenance of armored force vehicles, and firing of tank weapons. There are many army regulars stationed at the West Point post from various branches of the service—infantry, cavalry, field and coast artillery, engineers, signal corps. Although the academy was founded in 1802, the Point has been garrisoned as a military post since 1778.

Field training has been intensified re-



With latest instruments of modern warfare cadets learn to aim big guns

cently with the acquisition of several thousand acres of rugged country adjoining the academy grounds in the vicinity of Lake Popolopen. In June, construction was finished at Camp Popolopen, including barracks for 1,100 men and officers, dining hall, weapons building, and auditorium. The huge auditorium is used on rainy days to show training films and for various class instruction.

Surrounding the camp are new target ranges which include a 400-yard moving ground target range for .37-mm. antitank guns, rifle and pistol ranges, a 600-yard range for .50 caliber machine guns, and other areas for firing heavy field artillery. There is a section set aside for throwing live grenades and a "blitz" course where targets spring up in the woods to test the reaction speed of the cadets. A bayonet assault course, a skeet range and a "defense area" for laying mines and blowing craters are also in the new tactical training section.

Street fighting is taught amidst specially constructed buildings. The cadets learn to load military trucks on a freight train with three dummy flat cars of regulation size. In Lake Popolopen they practice landing with assault boats and building pontoon bridges.

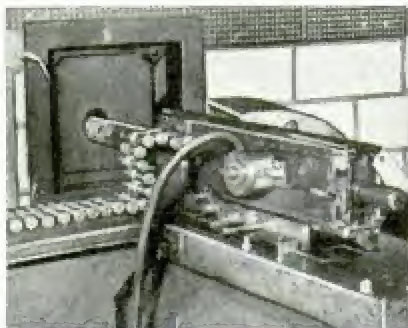
The ground cadets of the first class not only train at Camp Popolopen during the summer, but

(Continued to page 154)

Cadet demonstrates how to plunge bayonet through "vital" spot on dummy



Hang-Fire Test for Cartridges Guards Airplane Propellers



Above, testing gun on mount; below, recording of firing speed

Primers in cartridges for machine guns that fire through airplane propellers must ignite in a few ten-thousandths of a second, for the propellers and guns are synchronized to that split part of a second when the blades are clear of the bullet's path. Each new lot of such aircraft ammunition is tested for its firing speed on a hang-fire machine, which records the firing speed of each primer separately to within a ten-thousandth of a second, at the St. Louis Ordnance Plant, operated by United States Cartridge Company. The testing machine gun is attached to a steel fixture mounted on a block of concrete. Pressing the firing button of a control panel fires the belt of cartridges. The firing of each primer transmits an impulse to an electrically operated stylus, which marks the firing record of each on sensitized paper on a revolving drum.

"Anti-Sneeze" Kills Germs Carried by Water Vapor

Triethylene glycol, already coming to be known as "anti-sneeze solution," when sprayed into a room will kill pneumonia and streptococcus germs, the War Department has found. At the University of Chicago, where it was tested by Dr. Oswald H. Rob-

ertson, it was also claimed the solution will kill influenza germs and probably the virus causing common colds. Air-borne germs are carried on microscopic particles of water. The solution attaches itself to these droplets and smothers the germs. Though it was established the solution would not harm animals, there was a question about its effect on human beings. This was solved when it was discovered that certain buildings in New York and Washington had been using triethylene glycol in their air-conditioning systems to absorb excess moisture. The occupants of the buildings were exceptionally healthy—having unknowingly been living in medically pure air.

Belt-Driven Hole Digger Is Mounted on Tractor

Four bolts fasten a post-hole digger to the front end of any standard row-crop machine, and with such an installation holes up to 40 inches deep can be dug speedily. Its tilting mechanism, makers say, enables it to dig holes straight regardless of hills or hollows on the surface. The digger is driven by the tractor belt pulley, and other suggested uses are in planting shrubs, or making sounding holes for such construction as highway bridges. It can be attached to a tractor in nine minutes.



Holes up to 40 inches deep are made by tractor-driven digger



The CRAFTSMAN

Ship modeling - in a BOTTLE



By Anthony Ostroff

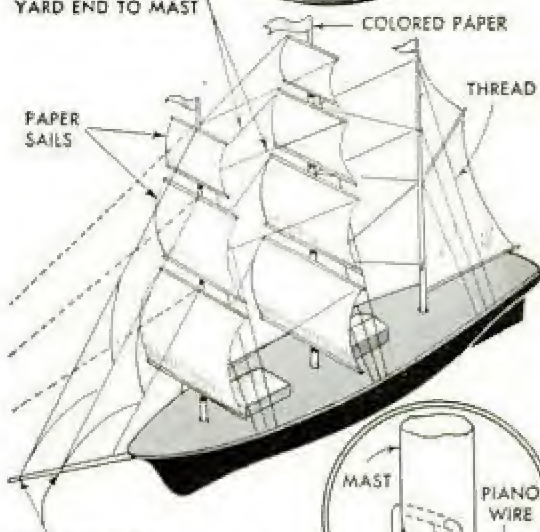
ONE of the most economical of craftwork hobbies—building tiny ship models in bottles—requires a minimum of material at practically no cost. Although the work may seem complicated and extremely delicate to the uninitiated, it is actually very simple. There are two methods in use: With the first method, which is used for the larger models, the masts are hinged on the hull to permit insertion of the completed model through the mouth of a bottle or lamp bulb, after which the masts are raised. With the second method, which is used for the smaller models in very small bottles, all of the parts are prepared separately, then inserted through the mouth of the bottle and assembled inside. In starting with this hobby, you should have a few simple but necessary tools and materials, such as a piece of razor blade, cemented in the end of a narrow dowel; a pair of good eyebrow tweezers; a number of picks made

RIGGING RUNS FROM YARD END TO MAST

COLORLED PAPER

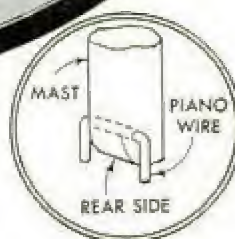
THREAD

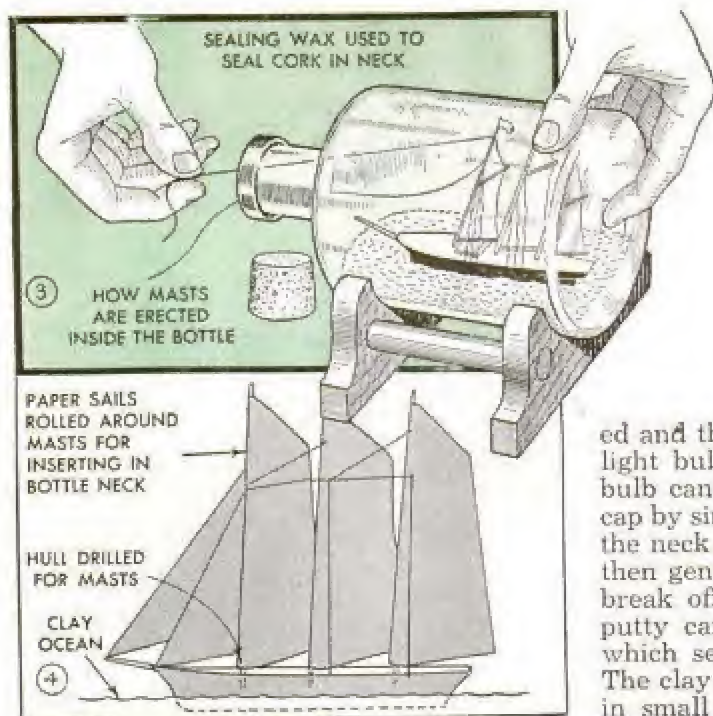
PAPER SAILS



BOWSPRIT STAYS GLUED IN PLACE AND TRIMMED AFTER RAISING MAST UPRIGHT

2





from needles stuck into the ends of thin shafts; a pair of long, narrow forceps; small brushes; scissors; some modeling clay; sealing wax; paint; model-airplane cement; some soft pine for making hulls; bamboo; thread and some thin paper. If you cannot get a pair of suitable forceps, take a 4-in. length of No. 16 piano wire, bend it double and grind the ends to a tweezer contact.

Beginners should start with the larger models that are folded and then inserted into a bottle or large light bulb of at least a 500-watt size. A bulb can be opened just below the screw cap by simply scoring it all the way around the neck with a small, three-cornered file, then gently tapping the cap so that it will break off clean. Green modeling clay or putty can be used to make the "water," which serves as a base to hold the ship. The clay is inserted into the bottle or bulb in small pieces, which are packed down tightly against the glass with a length of wire or dowel. Then the bulb is set aside and work is begun on the ship model. Carve the hull first, small enough to go through the opening of the bulb. Square-rigged ships such as the one shown in Fig. 2, look best and are easiest to build. After the hull has been carved and painted, you cut the masts from bamboo slivers and sand them. Sails are cut from paper and glued to the masts, which are hinged to the hull by tiny staples of piano wire, shown in the detail of Fig. 2. The ends of the staples are stuck into holes burned in the deck with a red-hot wire. Tiny drops of glue are applied to hold the hinges in place.

Next comes the rigging, all of which, except the bowsprit stays, must be fastened so that the masts can be folded down toward the stern but cannot be pulled forward past the vertical position. The bowsprit stays are left loose with enough extra thread to project out of the opening of the bulb. Then the masts are folded and the hull is put inside the bulb, firmly embedding it in the clay, after which the extending threads are pulled gently to raise the masts as shown in Fig. 3. This action, however, should

have been tested previously as shown in Fig. 1, with the ship outside the bottle, to see that the masts will be in the correct position when pulled forward. Now, with the ship in the bottle, and the masts erect, the threads are glued to the bowsprit and the loose ends are cut off. When locating a ship, the bow does not necessarily have to point toward the opening of a bottle, even though the masts must be erected while the ship is in this position. To obtain another setting of the ship, such as the mast tips pointing toward the mouth of the bottle, hold the ship with a pair of forceps while raising the masts and gluing the bowsprit stays. After the glue has dried, turn the ship so that its keel can be pressed into the clay ocean. To seal the bulb, a large cork is inserted in the neck so that it extends partly, permitting the part of the bulb with the screw cap to be slipped over the cork also, after which the joint is concealed with tape.

When you have mastered the technique of making the larger models, you can attempt one of the very small ones, where the model is assembled in a tiny bottle as small as one used for fingernail polish or in a small glass ball such as used to decorate fish bowls. A ball this size, containing a midget model, is shown in Fig. 6, and also above Fig. 6, the latter being an enlarged view. The "water" is modeling clay dropped through the opening in the form of small pellets, which are tamped down with any long, handy instrument. Models built with this method may be of any design, but the kinds shown in Figs. 4 and 5 have been found very attractive and easy to build. Instead of using thread for the rigging, you substitute bristles from a paint brush. Begin by carving the hull small enough to be slipped through the hole. Paint it, and fit on small deck houses cut from $\frac{1}{32}$ -in. wood. Burn mast holes in the deck as already explained to take the masts. A small bamboo sliver makes a good bowsprit. After the hull has been inserted into the ball or bottle, it is pushed into the clay. Sails are cut from paper and glued to masts made of slender bamboo splinters. After the glue has dried, roll the sails around the masts so that both mast and sail can be inserted into the bottle, and put in position as shown in Fig. 6. When the sails are straightened, they will be nicely bellied as the result of being rolled. After the rigging has been completed, the finishing touches may be put on, such as flags or pennants of colored paper and perhaps even whitecaps on the waves (white oil paint). The model can be tilted a little for better appearance and then the ball is ready to be sealed, which can be done with sealing wax.

Inexpensive Bead-Forming Tool Has Wood-Screw Cutter



Consisting of a flat-head wood screw and a file handle, this simple tool will come in handy the next time you want to form a half-round bead on strips of homemade molding, drawer fronts, etc. To assemble it, just drive the screw into the file handle until the distance from screw head to handle is equal to the desired bead width. In use, operate the tool in the same manner as a marking gage, working back and forth until it will cut no deeper. Finish rounding the bead with sandpaper held over the surface of a curved block.

Neat Rack for Artist's Brushes Made From Plastic Tumbler

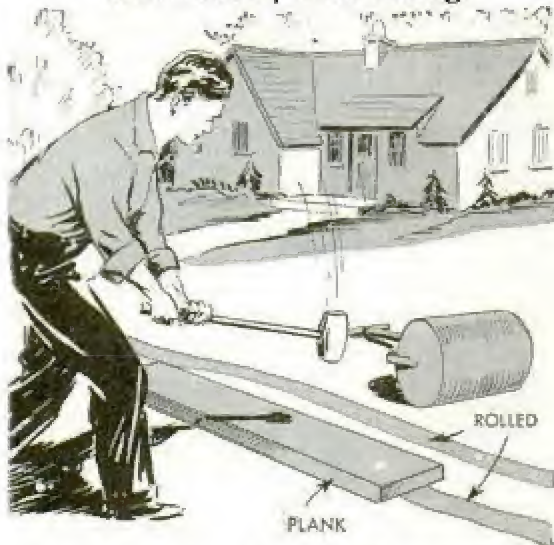


Inexpensive and easy to make, this combination rack and water container for artists' brushes was formed from an ordinary plastic tumbler, available at most ten-cent stores. All you need to do is saw

out a portion of the tumbler and notch the sides to accommodate three or more brushes. Then, smooth up the edges with a file or fine sandpaper. If a hand-type scroll saw is used for cutting this thin material, it's a good idea to select a fine blade and slip a block of wood inside the tumbler to brace the sides and avoid cracking.

☛ Cut in half, a rubber ball makes an excellent nonslip gripper for removing jar lids.

Ruts in Lawn Made by Car Wheels Leveled by Pounding



Ruts made in a lawn by the wheels of a car or truck can be removed without leaving any noticeable trace if the defaced area is rolled to make it compact, after which the ruts are pounded out with a thick plank struck by a sledge hammer as illustrated. This method is superior to raking over and reseeding, since reseeded spots are bound to show, due to the difference in color of the new and old grass.

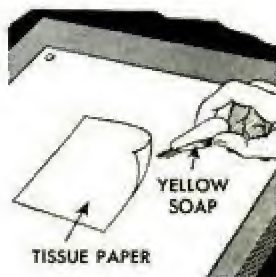
Tape Spool Holds Nail Polish Safely on Dressing Table



To avoid any possibility of upsetting a bottle of nail polish on your dressing table, place it inside the core of an empty adhesive-tape spool. This provides a nontipping base, the flanges of which provide a safe place to lay the polish applicator when not in use. Being small, the spool can be stored away in the drawer with the polish bottle.

Yellow Soap Holds Tissue Paper Fast to Drawing Board

As sheets of tissue paper are difficult to hold smoothly on a drawing board, I use yellow laundry soap as an adhesive. A sheet of plain white paper, larger than the

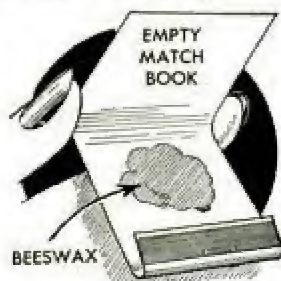


tissue sheets, is first tacked onto the board, after which the outline of each sheet is marked at the corners. Then soap is applied around the outline at each corner and the surface is ready for a sheet of tissue paper to be smoothed over it. For best results, new soap should be applied before attempting to stick down another sheet.

—G. E. Hendrickson, Argyle, Wis.

Wax Kept in Empty Match Book Is Handy When Sewing

Costing nothing, an empty match book provides a convenient place to keep a small amount of beeswax in the sewing-machine drawer, where it is always at hand to wax the ends of the thread.



After heating the wax, it is merely dropped in the empty book as shown, leaving the cover open for several minutes until the wax has again hardened.

Small Rope Used as Marble Ring To Play Game Indoors



When the weather will not permit children to play marbles outdoors where a suitable ring can be chalked on the sidewalk, you can provide them with a ring that can be used on the rug or linoleum. Simply join the ends of a length of cotton clothesline with a piece of adhesive tape. Marbles may be considered "out" when they strike the rope, or the game may be made more difficult by obliging the players to knock them over the barrier in order to score.

Realistic Bird Plaques Easy to Carve in Relief



Using only a few simple tools, you can carve relief plaques of flying birds such as this pheasant. Any close-grained wood can be used although attractive grain and sheen effects can be obtained if hardwood, such as walnut, is used. While the job does not require much artistic ability in drawing, as you can enlarge pictures obtained from magazines, care and patience in doing the work are the main requisites. After having had a picture enlarged, or drawing one, trace it on a piece of 1-in. stock and cut out the blank with a scroll saw or a hand coping saw. If a tail or wing extends beyond the limits of the piece of wood at hand, pieces of the same thickness can be doweled and glued on as indicated by reference A in the drawing above.

After the blank has been cut out carefully, begin shaping it by using a small block plane to taper the head. Begin at the neck and graduate the thickness down to $\frac{1}{4}$ in. at the tip of the beak. Also taper the wings from full thickness at the leading edges, down to $\frac{1}{4}$ in. at their trailing edges. Then the tail is tapered similarly, after which the body and head are rounded off by using a spokeshave, chisel and finally a rasp. Feathers on the tail and wings, and the other parts, are outlined by using a veining tool. Note that the head and breast of the pheasant are given a "speckled" appearance.

When the work of carving has been finished, you rub the surfaces down with sandpaper, progressing from a medium to a fine grade. The tongue, eye and ear of the pheasant are carved out separately and glued in place. Feathers can be improved further by marking them with an electric burning pencil. When the carving and marking have been completed to your satisfaction, the bird is finished either by simply waxing it or shellacking and varnishing, rubbing down each coat with fine pumice stone before applying the next. A three-coat varnish job provides a beautiful soft sheen when finished by a final rub of rottenstone and oil, using a felt pad.

—Ray L. Hedin, St. Paul, Minn.

☐ Cellophane strips 1 in. wide provide good ties for plants. The strips are strong, weatherproof, and will not cut the plants.

①

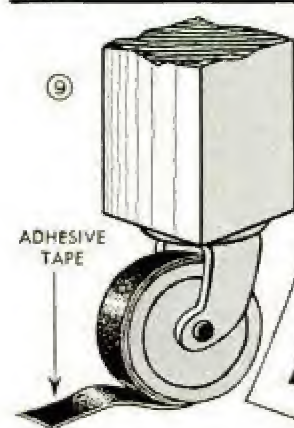
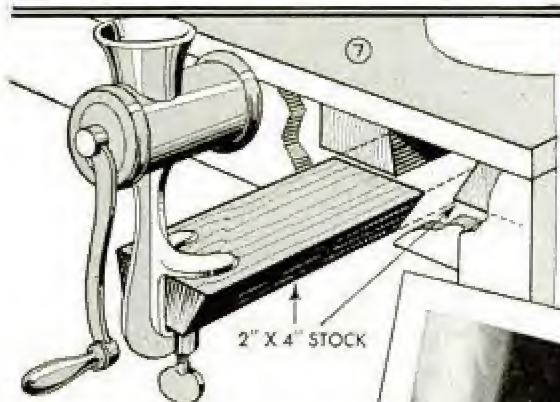
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KNOT TIED IN CLOTH

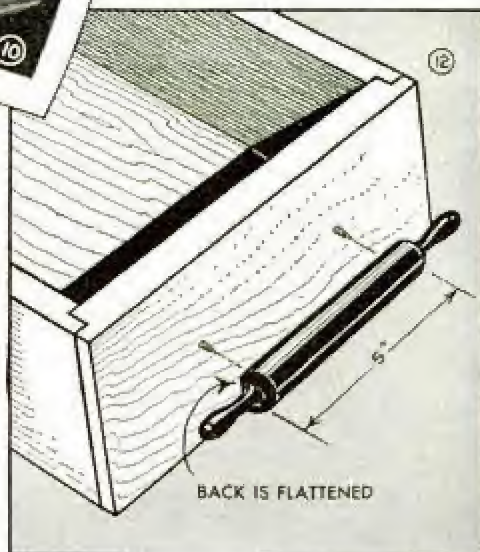
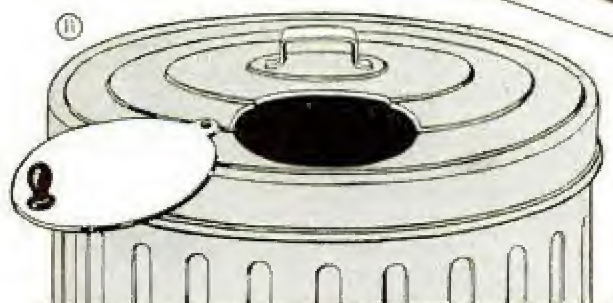
The image is a composite of three parts. The top left is a black and white photograph showing a close-up of a hand holding a wire hanger. The top right is a line drawing of a funnel with a spoon inside it, labeled 'SPOON' with an arrow pointing to the spoon. The bottom part is a line drawing of a wire hanger with a kink in the top loop, labeled 'KINK' with an arrow pointing to the kink. The hanger is shown with a decorative piece hanging from it.

PROBLEMS

7—In a home where a food grinder is used often, the task of clamping it on the edge of a table was simplified by screwing two beveled cleats to the underside of the table. This made it possible to leave the grinder clamped on a tight-fitting slide with edges planed to match the cleats. 8—Curtain-rod brackets can be attached without marring woodwork, if they are mounted on L-shaped, wooden blocks, screwed to the window frame as shown



9—One housewife prevents metal casters on heavy kitchen furniture from scratching the finish on linoleum by merely wrapping several layers of adhesive tape around the rollers. 10—Ideal for cleaning under rims of food graters, sifters and other cooking utensils, a wooden skewer will remove dirt or any accumulation of food particles quickly without scratching the metal



11—To eliminate the necessity of removing a garbage-can lid each time you want to deposit scraps from the table, cut a small opening in the lid and fit it with a sheet-metal cover, pivoted near the edge. 12—Especially suited to the kitchen are drawer pulls resembling rolling pins, which are turned from $\frac{3}{4}$ -in. dowels. Note that the backs are planed flat for attaching the pulls to drawer fronts with screws

Sled Used to Space the Seed Rows In Home Vegetable Garden



The runners of an ordinary hand sled are spaced about the proper distance advocated for seed rows in the home vegetable garden. By placing a rock or other weight on the sled, you can pull it across the garden to mark the rows, often as deep as required for planting some seeds. With this method, rows are marked off quicker than where a line must be stretched, and the spacing will be true from end to end throughout the garden.

Testing Repaired Auto Generator With a Small Drill Press

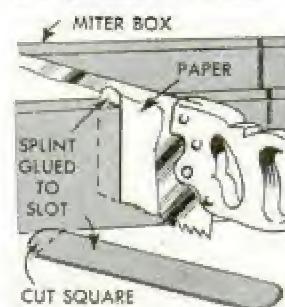
As practically all auto generators are fitted with bearings that can take considerable end thrust, they can be tested in a vertical position in a drill press after they have been repaired. To do this, hold one end in the drill-press vise and attach the end of the armature shaft to the drill-press chuck. This can be done by one of two



methods: If the armature shaft has an internal thread for a bolt which holds a pulley in place, a drive for the generator can be made by cutting the head from a bolt and chucking it in the drill press. Where the end of the generator shaft is threaded for a nut, it will be necessary to turn a suitable nut to go on the shaft and provide a grip for the drill-press chuck. Then, by connecting the generator in the usual manner to a battery, using an ammeter in the circuit, the generator can be operated until thoroughly heated to be sure it will function satisfactorily when installed in the car.

Repairing Worn Miter-Box Slots

If the slots in a wooden miter box have become so worn that strict accuracy is no longer possible, they may be renewed by using thin wooden strips. Tongue de-



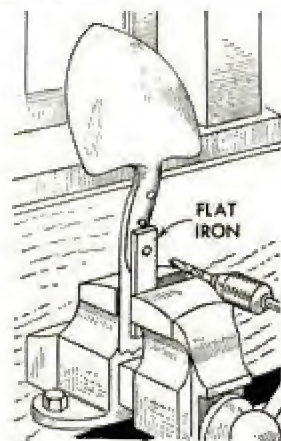
pressors used by doctors in examining the throat are ideal for the purpose. These are glued to one edge of each worn slot as indicated. In some cases, it may be necessary to square up the slots if the wear

has not been uniform throughout their height. Thick wooden wedges will hold the splints in position until the glue dries or folded strips of paper can be wedged tightly in the slots to serve the same purpose.

—W. C. Wilhite, Carlinville, Ill.

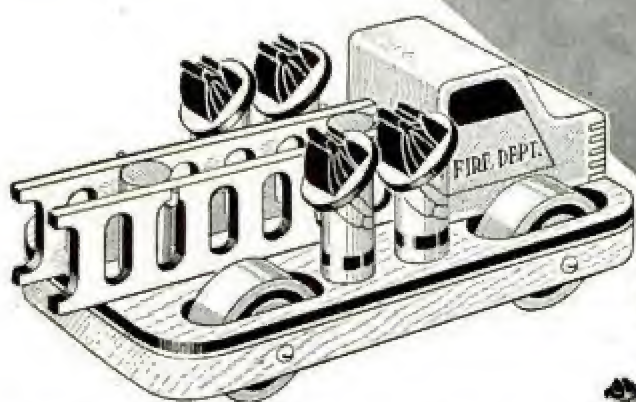
Broken Shovel Handle Removed With Aid of Drill Guide

To remove countersunk heads of rivets from a shovel to release a broken handle, just drill a hole through a piece of flat iron to serve as a guide and clamp this in a vise along with the shovel so that the hole is directly over the rivet head. The drill may then be inserted and held

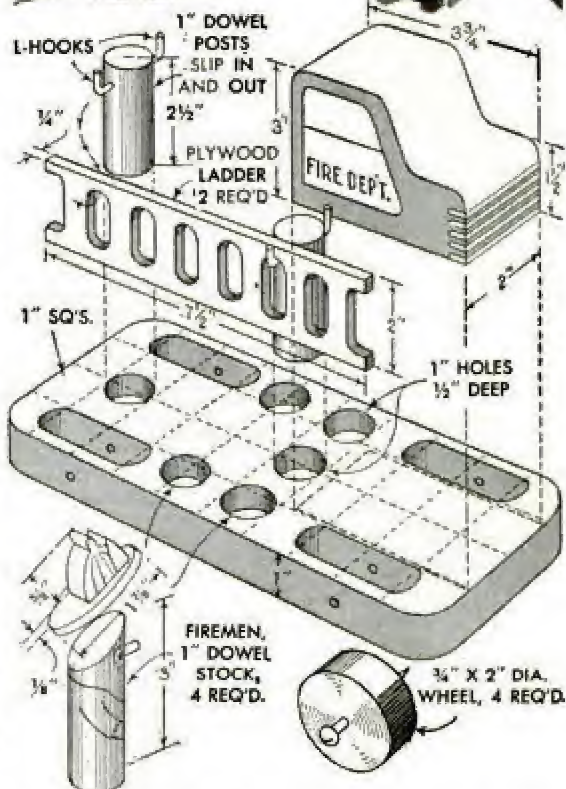


securely over the rivet until enough of the head is drilled off so that it can be driven out. If a suitable vise is not at hand, the flat-iron guide can be held in place with C-clamps while operating the drill.

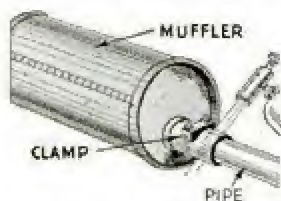
This All-Wood Fire Truck Will Delight Any Boy



Every small boy who has a yen to be a fireman will get hours of pleasure from this colorful fire truck. Constructed so that the firemen, the ladders and the posts that support them are all removable, the truck can be used for other play purposes. For the base, use a piece of 1-in. stock, 4 by 10 in. in size, round the corners and cut out the slots for the wheels. This is done by drilling out as much of the waste stock as possible and finishing with a sharp chisel. Then drill 1-in. holes $\frac{1}{2}$ in. deep to accommodate the firemen and ladder posts. The cab is a solid block sawed from 2-in. stock, and is glued and nailed to the front of the base between the two front-wheel slots. Cut the 2-in. wheels from $\frac{1}{2}$ -in. stock, drill $\frac{1}{4}$ -in. holes through their centers and fasten them in the slots, using screws or nails as axles. The ladder supports are $2\frac{1}{2}$ -in. lengths of 1-in. dowels, and have L-hooks driven into opposite sides near the tops on which to hang the ladders. Saw the two ladders from $\frac{1}{4}$ -in. material, and cut four sections of 1-in. dowel for the firemen as shown, the brims of their helmets being cut from $\frac{1}{8}$ -in. material and the tops shaped from 1-in. stock. Glue the tops to the brims, and the brims to the dowels, using pieces of $\frac{1}{8}$ -in. dowel glued on for the noses. Fasten a cord to the front and paint the toy a bright red. Two or three turns of adhesive tape around each wheel will help reduce noise if the toy is pulled over uncarpeted floors.

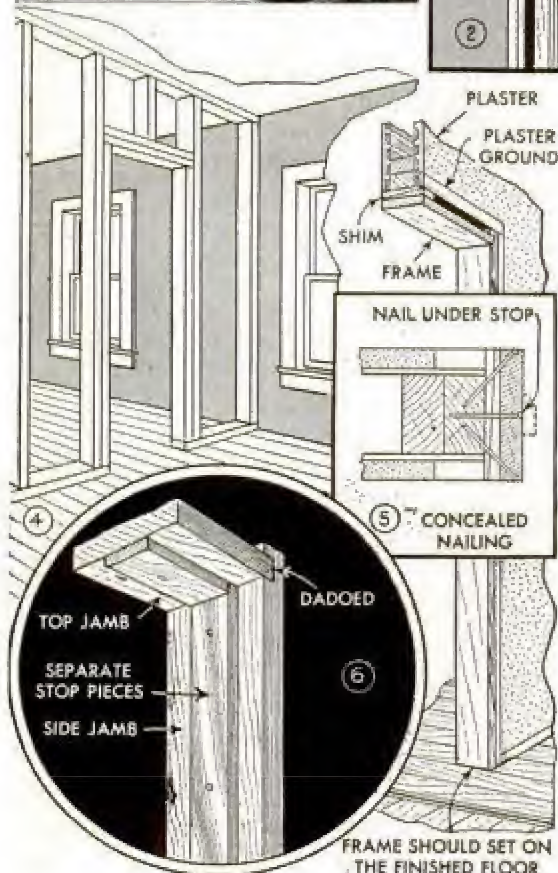
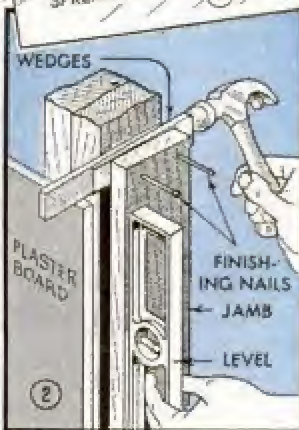
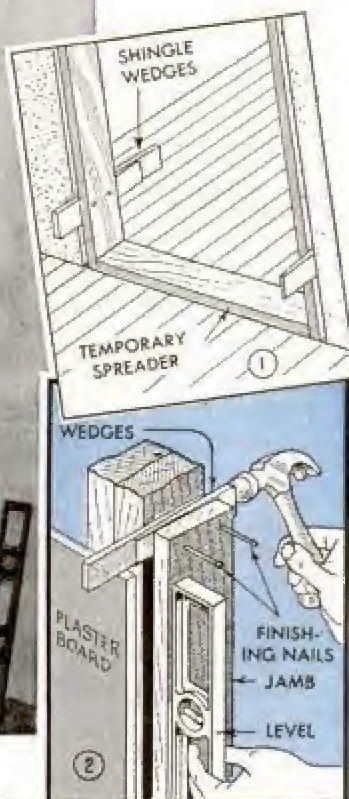


Heat Applied to Exhaust Pipe Makes Car Muffler Easy to Remove



When a muffler has to be replaced, you can make the job of taking out the old one easier and save time by doing the job as follows: Heat the exhaust pipe where it joins the muffler to a red color and then twist and pull on the other end of the pipe and it will slip off as the heat expands the outside joint more than the inside one. Before doing this, however, it is important that the muffler and pipe together be removed from the car before applying heat, to avoid igniting grease or gasoline.

How to FRAME



IF YOU cannot obtain the services of a skilled carpenter to install an interior door, you can do a good job yourself with a few simple tools. First you make the opening in the wall. This should measure 3 in. more than the height, and 2 in. more than the width of the door itself. This allowance provides for the thickness of the door frame, for the shims or wedges by which the frame is set true, for expansion and door-swinging clearance, and for the finish floor if laid after the doorway is framed. If the finish floor is already laid, deduct its thickness from the height allowance.

Fig. 4 shows the usual type of partition wall framing with the door opening made. Notice that a double header is installed at the top and that extra studs are set in at the sides. After preparing the opening, you are ready to install the door frame. It is recommended that this be set on

the finish floor rather than on the rough floor. Therefore, if you are working on the rough floor, slip a block of the finish flooring under the frame on each side temporarily to raise it up to the finish floor level. This makes it easy to do a neat job of laying the floor at this point. In most cases it is best to purchase the door frame already assembled, although stock jambs for making up frames are available in three widths, the material being slightly oversize to allow for trimming.

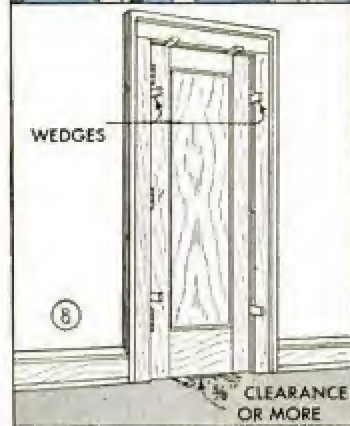
To set the frame true in the opening, pieces of shingle can be used to good advantage as wedges or shims between the frame and the studding on both sides and at the top as indicated in Fig. 3. Any twist that may be in the frame can be taken out by driving the wedges in more from one edge of the jamb than from the other as shown in Fig. 2. A spreader, consisting of a board accurately cut to the width of the opening as in Fig. 1, will be found handy to keep the side jambs properly spaced while setting the frame. See that some of the wedges are placed where they will provide solid backing for the lock and hinges. The placement of these can be determined according to the following rules:

and HANG a Door

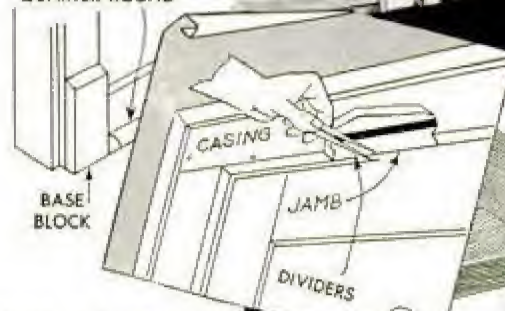
Place the top of the upper hinge about 5 in. from the top of the door, or in line with the top door rail, and the bottom of the lower hinge 10 in. from the bottom of the door, or in line with the bottom rail, as in Fig. 8. The height of the door knob, which determines the placement of the lock, should be 3 ft. from the floor.

Naturally, the nails through the jambs to secure the frame must be driven where they will not interfere with installing the hardware. Therefore, mark the approximate positions of the lock and hinges on the jambs before you begin to nail. The nails can be driven as in Fig. 2, or you can conceal them by driving them as in Fig. 5. After the frame has been nailed securely, nail on the casing, setting it back $\frac{1}{4}$ in. from the edge of the jamb to allow room for the hinges. See Fig. 15. Then tack on the stops temporarily with nails driven in part way. Fig. 9 shows a section of one side of a completed door frame.

Before hanging a new door, cut off the horns as in Fig. 7, and plane just enough of the excess material off the sides to permit it to be slipped snugly into the frame, Fig. 10. Then, with dividers or a scribe, mark a line on the door true with the top jamb as shown in Fig. 11, and cut off the top of the door. Now, before you do any further trimming, you must decide on the clearance to be allowed between door and frame. The proper clearance for the door you are hanging is based on two factors: First, the weather conditions of your locality, and second, the kind of finish that will be applied to the wood. In a dry locality, a clearance of $\frac{1}{16}$ in. is about average for a door that is to be stained and varnished, or $\frac{3}{32}$ in. if it is to be painted. In a damp locality a clearance of $\frac{3}{32}$ in. is



QUARTER ROUND

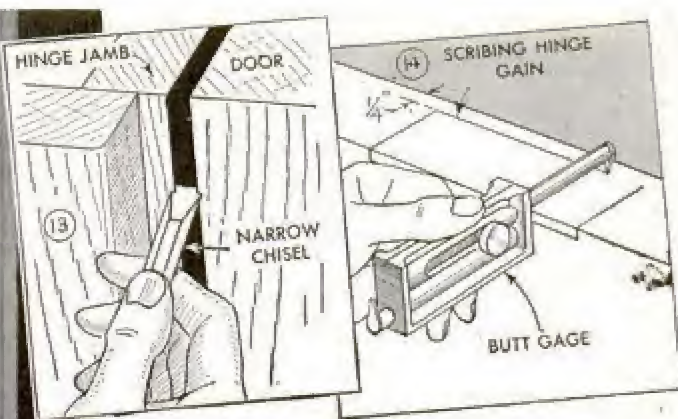


PAINT END GRAIN TO SEAL WOOD FROM MOISTURE

SIZE OF BUTT HINGE TO USE

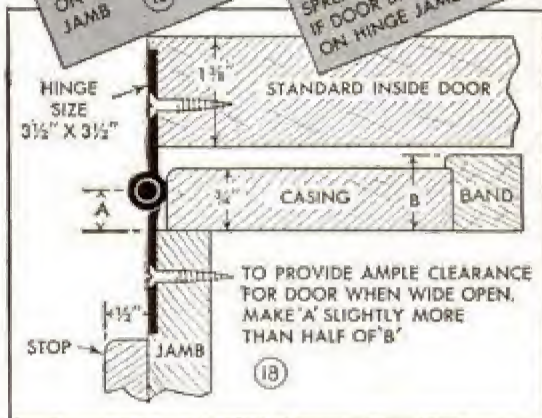
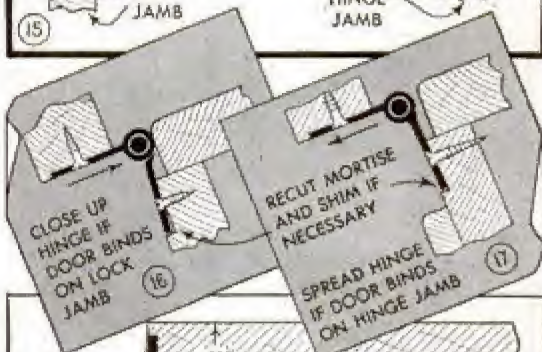
Size of door	Size of hinge
1½ to 1¾ in. up to 32 in. wide	3½ in.
1½ to 1¾ in. from 32 to 37 in. wide	4 in.
1¾, 1¾, 1¾ in. up to 37 in. wide	4½ in.
1¾, 1¾, 1¾ in. from 32 to 37 in. wide	5 in.
1¾, 1¾, 1¾ in. from 37 to 43 in. wide	5 in. ex. heavy
1¾, 1¾, 1¾ in. from 43 to 50 in. wide	6 in. ex. heavy
2, 2½, 2½ in. up to 43 in. wide	5 in. ex. heavy
2, 2½, 2½ in. from 43 to 50 in. wide	6 in. ex. heavy

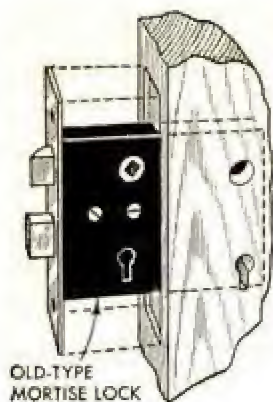
Doors larger than 5 ft. should have three butt hinges, one for each 2½ ft. of height



case, note the way in which the temporarily mounted half of the hinge adjusts itself to the movement. Then take down the door, unscrew the hinge from the jamb and recut its mortise to close up or spread the hinge, whichever is required, Figs. 16 and 17. It may be necessary to shim up one side of the hinge with a strip of cardboard if too much wood has been cut away. Be sure to get the hinges out far enough to prevent the door, when wide open, from binding on the casing trim or striking the base block, if base blocks are installed. See

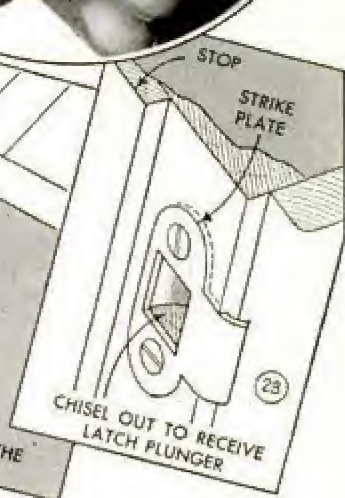
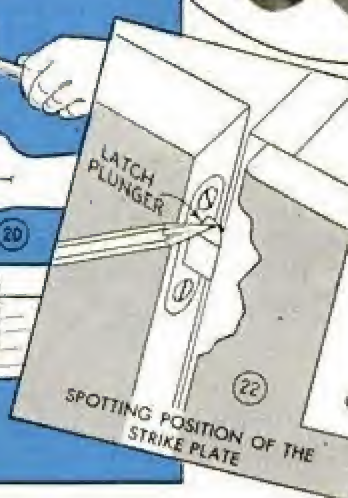
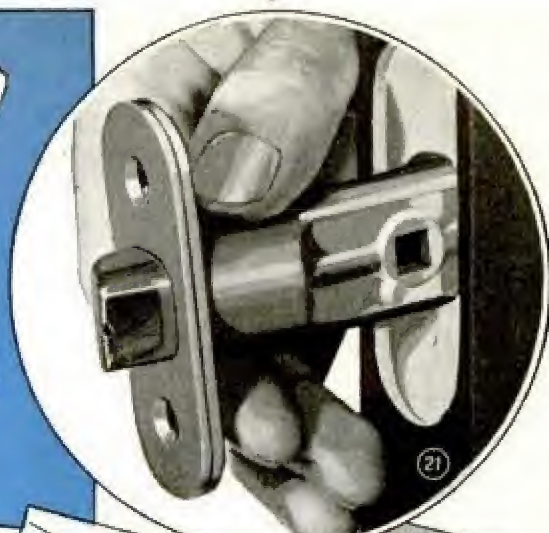
Diagram 15 illustrates a cross-sectional view of a door hinge assembly. The door is shown with a hinge pin inserted into the hinge jamb. The door is set back 1/4 inch from the casing. The hinge pin is secured with a stop. The door is beveled for clearance. The lock jamb is also shown. The diagram is labeled with '15' in a circle.





detail below Fig. 8. By making distance A in Fig. 18 slightly greater than one half of distance B, ample clearance will be assured.

Next, install the lock or latch set by cutting the body mortise into the lock stile of the door. In the older type of sets, this entails drilling holes and then chiseling out the wood as shown in Figs. 19 and 20. Very little chiseling is required in the installation of the type shown in Fig. 21. Cutting it in is simply a matter of drilling holes. Careful placement of the strike plate is essential if a latch or lock is to operate smoothly without causing the door to bind or allowing it to rattle. Spot the position of the plate by hanging the door, closing it and turning out the latch plunger so that it touches the jamb as shown in Fig. 22. Do the same with the lock plunger if the set is a combination. Mark the location of the plunger, top and bottom, and carry these marks squarely across the jamb to a point corresponding to the depth at which the plunger is set back from the face of the



door. Then place the plate in position over these marks and, with a scratch awl, outline the mortise and then spot the screw holes. Cut out the mortise and screw the plate in place as in Fig. 23.

Finally, adjust the stops to the latched door, allowing clearance for the paint or varnish finish, and nail them permanently in place, Fig. 6. Oil the hinge pins and latch to make the door work smoothly. Later on, if the door should bind due to swelling, do not attempt to trim off the lock edge, which would entail moving the lock. It will be easier to dress off the hinge edge and resink the hinges accordingly.

Automobile Polishing Simplified With Camphor Solution

As my car is exposed alternately to sunshine and salt-laden night air, the job of cleaning the lacquer finish on it must be repeated frequently. However, I have been able to keep the car in an attractive condition with the expenditure of only a small fraction of time required with ordinary methods by using a solution consisting of gum camphor, 1 cake, dissolved in light mineral oil, 1 pt. This is applied with a soft cloth every two weeks and allowed

to remain overnight, a clean, soft cloth being used to wipe it off the next morning. Camphor seems to have a beneficial effect on old lacquer finishes, at the same time helping to remove the dull film of oxidized material without harming the lustrous finish beneath. It must be remembered, however, that this treatment is not extended to synthetic or enamel finishes as their composition differs from cellulose lacquer.

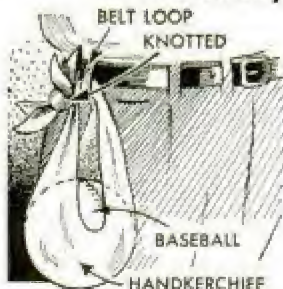
—B. W. Downs, Los Angeles, Calif.

"Bird House" Holds Clothespins Handy at Your Line



Mounted permanently on one of your clothesline posts or other suitable support handy to the wash line, this clothespin box is built to look like a bird house. It can be made of scrap wood and painted a gay color to enhance its attractiveness. A hinged roof makes the pins accessible.

Pocket Made From Handkerchief To Carry Baseball

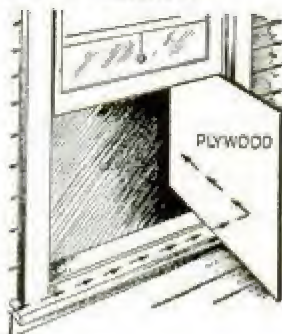


The difficulty of carrying a baseball, when one is not wearing a coat or blouse with convenient pockets, may be overcome by knotting the four corners of your handkerchief through a side

belt loop of your trousers. This provides a pocket into which the ball may easily be slipped or removed.

Adjustable Deflector Directs Air Into Bedroom Window

On a hot night when the breeze does not blow into the bedroom window, but past it, a deflector of the type shown will direct the air into the room. Such a deflector can be used only on windows having no

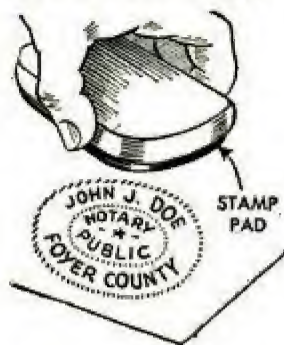


screens or those that have screens that can be raised from inside the room. The deflector is merely a piece of plywood or hard-pressed board set on the edge between the sill and lower part of the sash as indicated.

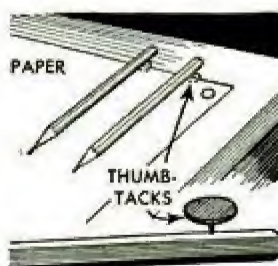
—Joseph Victor, Libertyville, Ill.

Ink Pad Brings Out Relief Stamp Of Notary Seal for Photo Copy

To make photo-static copies of papers bearing a Notary or Justice seal, in which the seal must register clearly, rub the seal print gently with a rubber-stamp ink pad. The pad should be inked with black ink for best results.



Pencils Hooked Over Paper Edge Are Handy at Drawing Board



One of the simplest methods of keeping pencils conveniently at hand on a drawing board is to force thumbtacks into the sides of them near the top to provide hooks that can be slipped over the top edge of the paper as shown. Where the drawing board is kept at a slight angle, the thumbtacks also provide a flat surface that will prevent the pencils from rolling when not in use.

Shoe Polish Is Aid in Scribing Clear Lines on Metal

Next time you have to scribe a number of fine lines on a piece of sheet metal, you can make them show up clearly for accurate cutting or drilling by first coating the area with black or brown liquid shoe polish. The polish dries quickly and may be removed after the work is finished in cases where the completed piece is to be painted.

—Wm. Swallow, Brooklyn, N. Y.

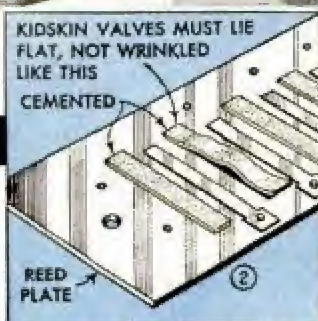


Tuning and Repairing HARMONICAS

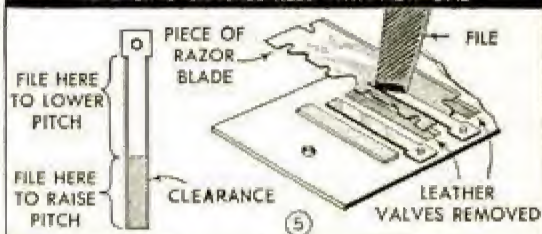


① BE CAREFUL NOT TO BEND THE REED PLATE WHEN DISMANTLING

"TUNING and repairing harmonicas is simple if you are patient and observing," says Bob Ballantine, harmonica virtuoso of the National Barn Dance radio show. First, however, familiarize yourself with the theory of harmonica operation by taking apart and studying one of the instruments as in Fig. 1. In doing this, be careful not to bend the reed plates. The two parts most likely to give trouble are the brass reeds and the leather valves, the latter being found only on the more expensive chromatic harmonicas. If the valves are curled badly, they must be replaced with new strips cut from kidskin, Fig. 2, although in some cases it may be possible to still use the old valves if they are loosened and turned over so that they will lie flat. Any liquid cement can be used to fasten the valves in place on the reed plates. If the reeds lose their pitch, they can be retuned usually by filing their surfaces. The pitch is raised by filing the vibrating half of the reed, and is lowered by filing the half closest to the riveted end. If filing does not bring back the pitch and tone, the reed must be replaced as it probably is cracked. To do this, remove the leather valves on either side of the bad reed. File off the head of the rivet and punch it out as in Fig. 3, being careful not to enlarge the hole. Then take another reed from an old harmonica. Insert a brad the exact size of the rivet hole through the reed, clip it off, Fig. 4, and peen the end slightly with a small hammer. Hold the brass plate up to the light to see that there is clearance on all three sides between the reed and plate. The reed must have room to vibrate freely. If it fits tightly on one



④ SMALL NAIL CAN BE USED AS RIVET IN REPLACING CRACKED REED WITH NEW ONE



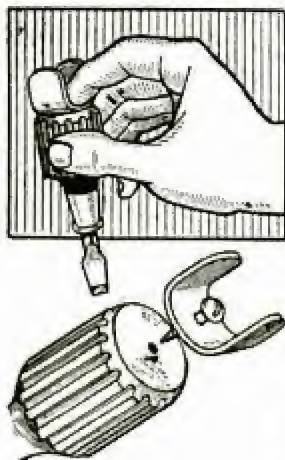
side, file it until the clearance is the same on all sides. Test the pitch of the reed by flicking with the fingernail and tune by filing. Fig. 5 shows how a piece of safety-razor blade is slipped under the reed to support it while filing. To keep a harmonica in good condition, wrap it in waxed paper and keep it in a box when not in use. Never wash the instrument or submerge it in water. It should not be played immediately after you have eaten.

Nonslip Treads of Roofing Paper For Concrete Steps



Where concrete steps get wet and slippery, or where they would present a better appearance if provided with treads, cheap but durable treads of slate-coated asphalt roofing paper can be applied easily. After cleaning the concrete, cover the surface with asphalt cement, which may be spread uniformly with a putty knife. It is best to apply just enough to provide a tacky surface—not so much that the excess will ooze from under the paper when it is pressed down. Then stand on each tread to press it down firmly. If the pieces have a tendency to curl, you can lay a bag of sand on each one, leaving it there overnight. Turpentine is used to clean asphalt cement from the putty knife, hands and from surfaces where some of it may have been dropped. To “anchor” the slate chips so that they will not be dislodged from the roofing paper, apply two or three coats of spar varnish or waterproof cement paint.

Use of a Short Screw Driver Simplified by Finger Grip



When a stubby screw driver is used in tight places, operation of it can be simplified considerably by adding a finger grip consisting of a piece of sheet metal bent to a U-shape and attached to the top of the handle with a screw. When drilling the metal grip for the attaching screw, be

sure the hole is sufficiently large to permit it to turn freely. Also, it's a good idea to run a file over the screw head several times after it is in place, to remove any sharp pieces of metal that might cut the fingers while using the screw driver.

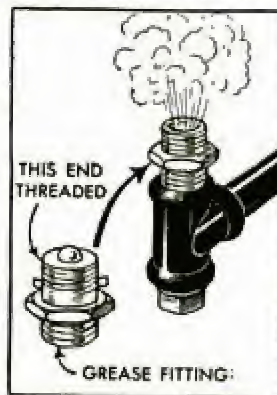
Bench-Vise Operation Improved By Metal Furniture Glides

If you have a workbench fitted with a conventional wooden vise of the type shown, its operation can be improved by adding two furniture glides to the bottom of the sliding jaw. The length of the jaw plus the thickness of the glides should be equal to the height of the working surface of the bench so that the vise screw will be in a horizontal position when it is extended. With this arrangement, the jaw will slide easily on a reasonably smooth floor as the screw is turned making it unnecessary to stoop and pull or push the lower end of the jaw into position.

—J. M. Gaines, Brevard, N. C.



Safety Valves for Small Apparatus Made From Grease Fittings



Safety valves for appliances such as pressure cookers, automatic heaters, dental and tire vulcanizers, as well as small paint-spraying outfits and air-compressing units, can be made from Alemite grease fittings. All you have to do is thread the

smooth end of the fitting with a $\frac{1}{8}$ -in. pipe die so that it can be screwed into the appliance in a reversed position. This type of fitting has a spring-loaded ball to seal it against the entrance of dirt and the back pressure of grease. When screwed into an appliance in the reversed position, pressure in the appliance works against the ball and spring, which will release at approximate 18 lbs. pressure. If a higher pressure is desired, remove the spring and stretch it slightly. This will cause it to release at a slightly higher pressure.

All-winter VEGETABLE STORAGE

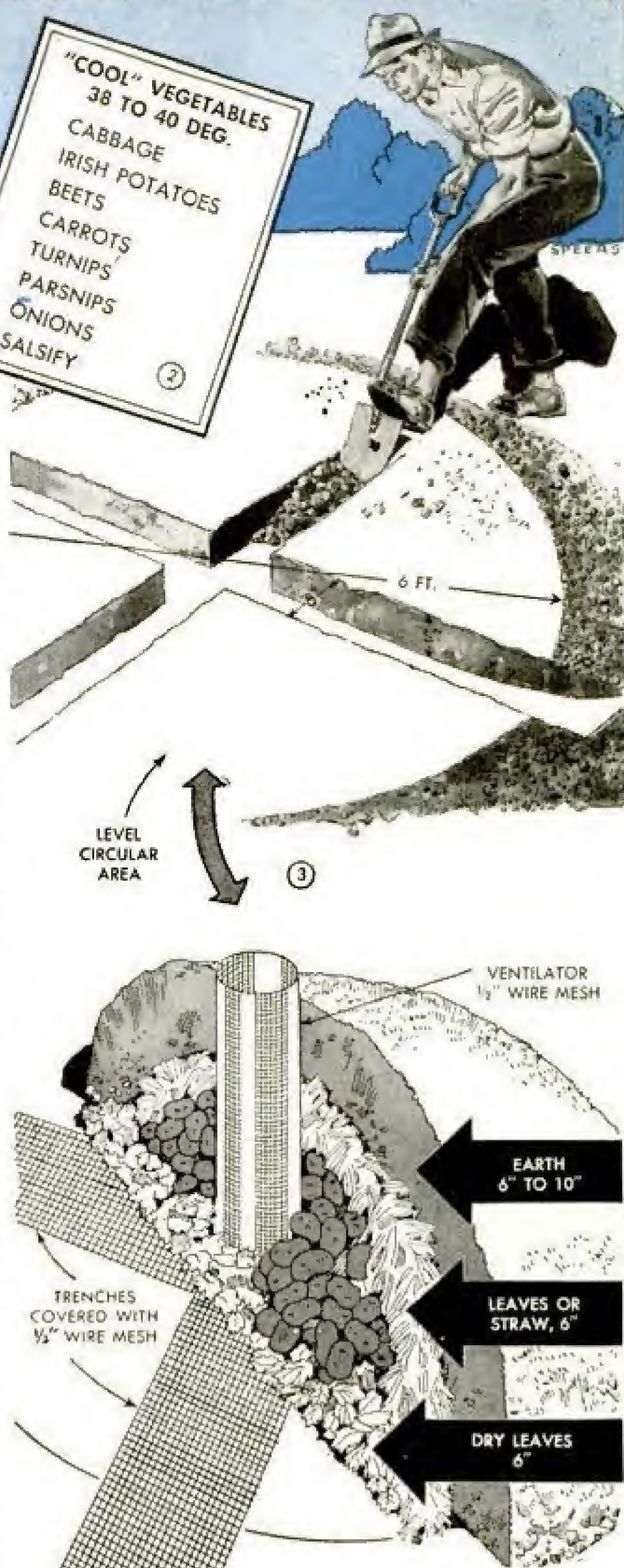
"WARM" VEGETABLES
50 DEG. OR HIGHER
SQUASH
PUMPKIN
SWEET POTATOES
BEANS
PEAS ①

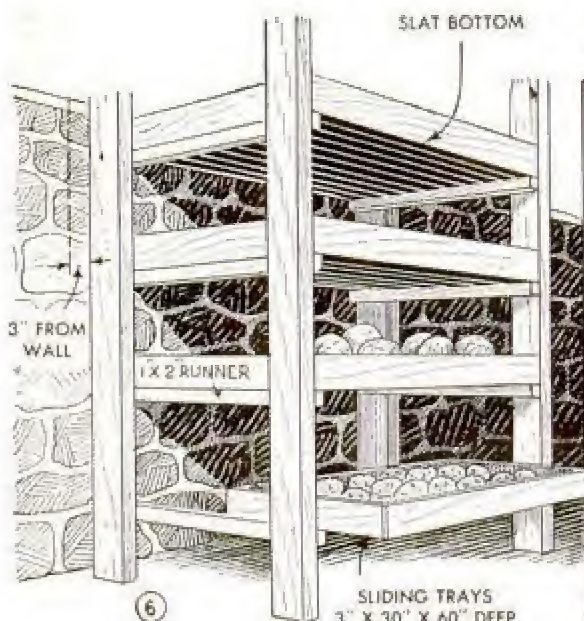
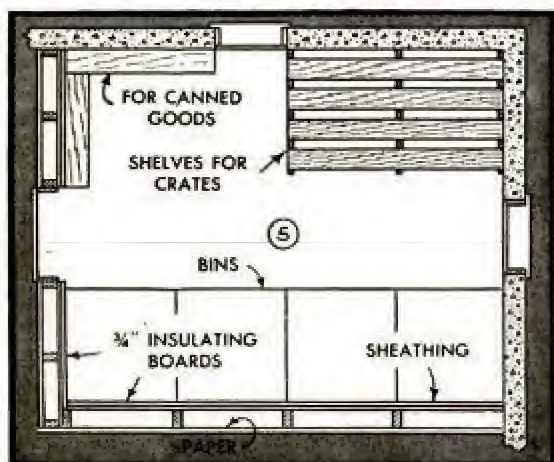
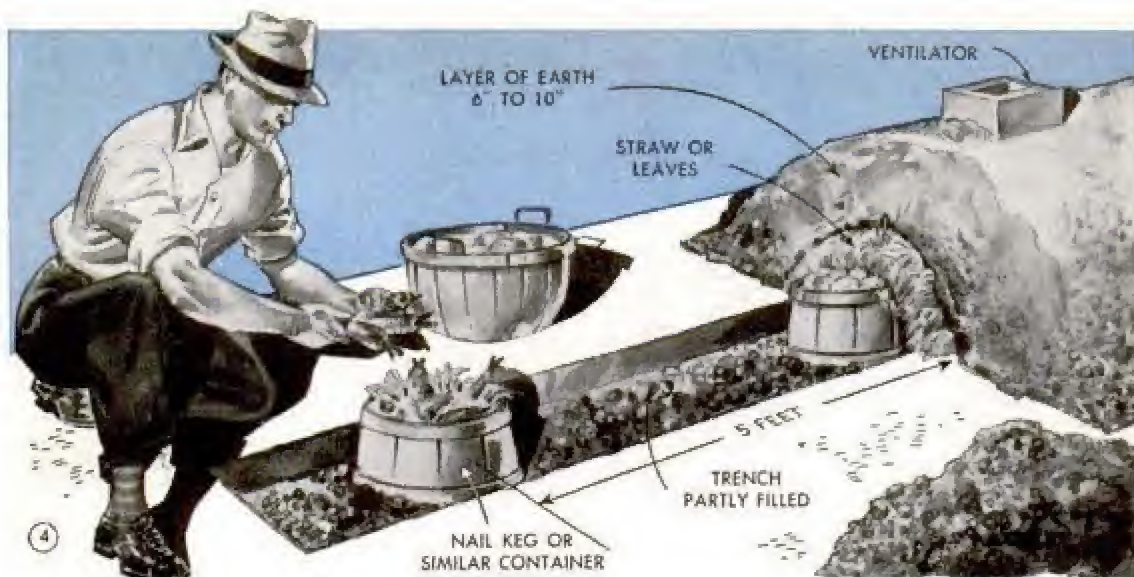
"COOL" VEGETABLES
38 TO 40 DEG.
CABBAGE
IRISH POTATOES
BEETS
CARROTS
TURNIPS
PARSNIPS
ONIONS
SALSIFY ②

By W. C. Lammey

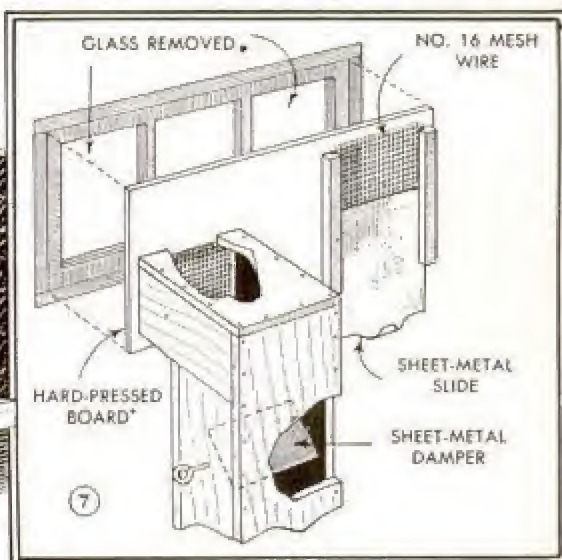
WHEN storing vegetables there are three essentials to safe keeping: quality, temperature and humidity. None but sound vegetables of first quality should be selected for storing. Figs. 1 and 2 list the principal "warm" and "cool" vegetables. Those in Fig. 2 keep best when stored at a temperature of 38 to 40 degrees F. and under conditions of relatively high humidity. Temperature is controlled more easily than humidity. It is difficult to maintain the proper temperature and humidity in the average home basement for "cool" vegetables while "warm" varieties will generally keep very well under these conditions. One good plan for storing the "cool" vegetables, particularly the root crops, potatoes, beets, carrots, and so on, is in an outdoor mound made as shown in Fig. 3. Select a high spot from which there is good drainage, level a circular area and dig cross trenches as shown. Cover these with wire if available, or with wooden slats. A wire or wooden ventilator should also be provided. A wooden one is made square, from 1 by 6-in. stock and a series of $\frac{1}{2}$ -in. holes are bored through each side. Place the vegetables on leaves or straw in a conical pile not more than 30 in. high. Cover as indicated, but leave the ends of the trenches open until lower temperatures during winter make it necessary to close them with straw and earth.

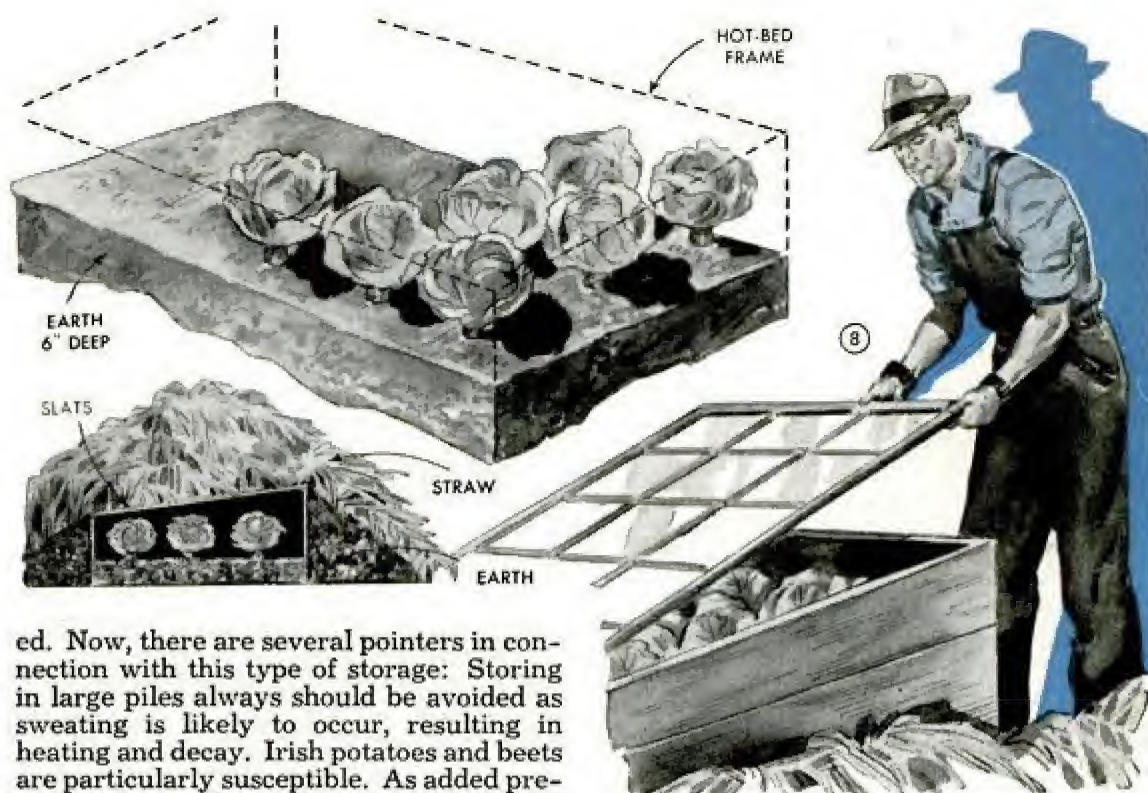
Fig. 4 shows an excellent arrangement for storing vegetables in separate containers from which





a quantity can be removed as needed without disturbing the rest. The details are self-explanatory. Any number of containers can be used. If suitable kegs are not available, bushel baskets will serve. If sand is obtainable, use it to fill the trench. Similar arrangements are shown in Figs. 8 and 9 and 12 and 13. Figs. 8 and 9 show use of a hotbed for storage of cabbage and celery. In each instance remove the original soil and compost or manure bottom from the hotbed. The cabbage heads are pulled roots and all and "planted" in fresh soil as indicated. Only the roots need be buried. Then, cover as indicated. Celery, Fig. 9, may be kept in the same way. In Figs. 12 and 13 the vegetables are stored in a barrel placed in a shallow pit which has been partly filled with sand. The end of the barrel is only partly closed as indicated. When an opening is left in the earth covering in the earlier months no vent is need-

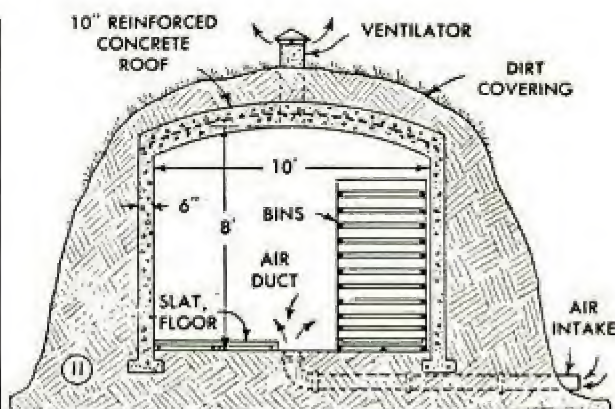
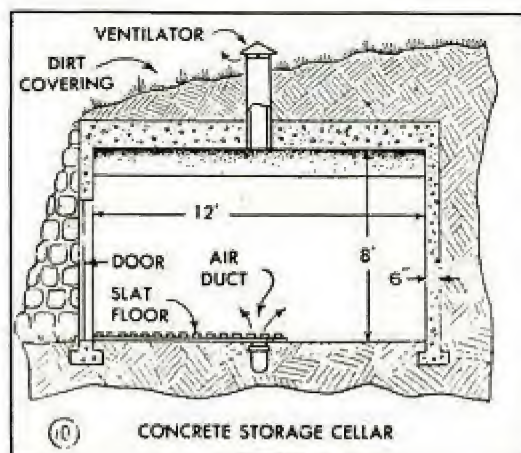




ed. Now, there are several pointers in connection with this type of storage: Storing in large piles always should be avoided as sweating is likely to occur, resulting in heating and decay. Irish potatoes and beets are particularly susceptible. As added precaution in any form of mound storage, dig a shallow drainage ditch around the mound. Tops of the ventilators should always be covered to prevent entrance of rain and snow. The next best thing to the mound storage of small quantities of cool vegetables is a basement storage room built in a corner as detailed in the plan view Fig. 5. Dimensions can be whatever is desirable, but 10 by 12 ft. is a good average. When the floor is concrete you have the problem of humidity, but this can be at least partially solved by waterproofing the "sills" of the two walls and covering the floor with a half and half mixture of sand and peat moss to a depth of about two inches. This should be kept damp at all times. Walls should be tight clear to the sub floor to exclude dry air and heat from



⑨ CELERY STORED IN HOTBED

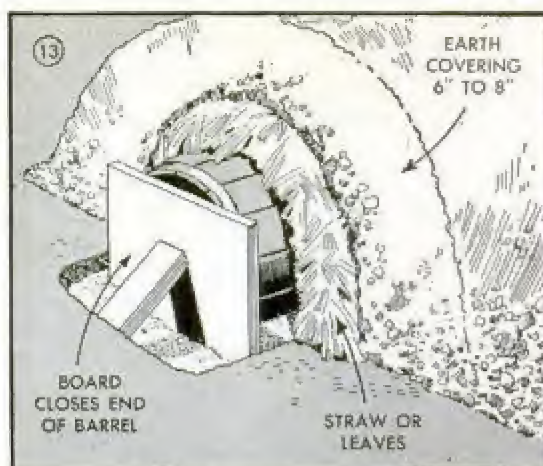


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U. S. Dept. of Agriculture



the furnace room. Paint all window glass black or cover with black paper to exclude light. Fit a ventilator over one window as in Fig. 7. The intake duct, the lower one, exhausts air at a point about 10 in. above the floor and is fitted with a swinging damper. If sheet metal is not available for these parts use box boards or wall board. Both inlet and outlet should be covered either with wire or closely spaced slats. With this arrangement it is possible to control both temperature and humidity with a fair degree of accuracy. A handy bin arrangement is shown in Fig. 6. The sliding trays make cleaning easy and during the summer they can be removed and stacked and the space used for other purposes.

Figs. 10 and 11 detail a more pretentious structure of a permanent type to be built into a hillside or on high ground from which there is drainage in all directions. Walls, roof, and ends are of reinforced concrete but the floor is of earth. This type of structure results in good storage conditions for vegetables, particularly root crops. It is always better to store the cool vegetables in shallow bins with slat bottoms than in baskets or barrels. However, where either of the latter must be used, the wooden barrel is usually best. A number of $\frac{3}{4}$ -in. holes bored through the barrel staves near the bottom will aid air circulation. Pumpkins and squashes usually will keep well



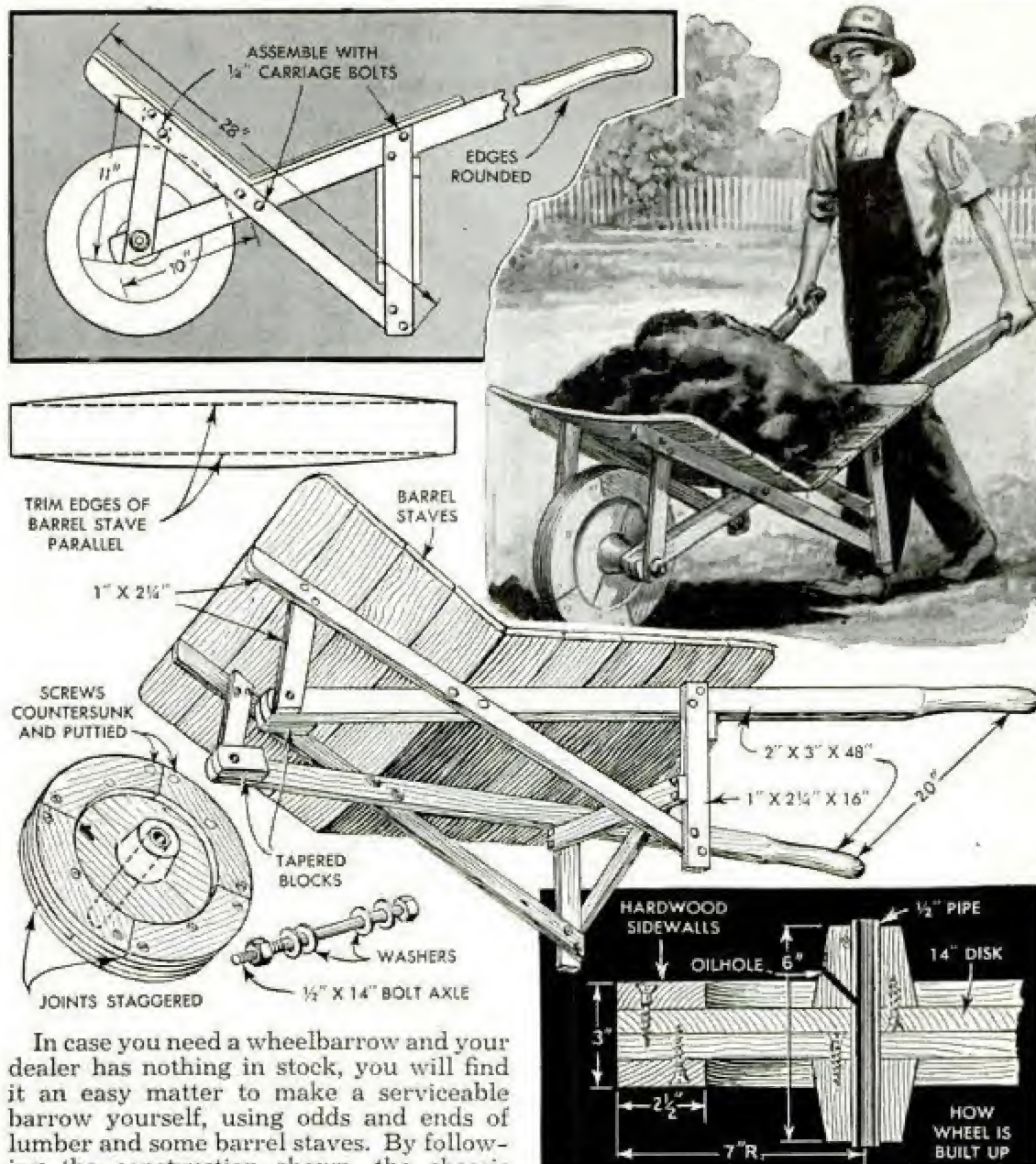
in a dry, well ventilated basement, or anywhere in the house where there is no danger of freezing. They should not be piled but rather placed in rows on a shelf. The attic floor is generally a good place to keep peas and beans, after curing on the vine. Pick pole beans as soon as they are mature and spread the pods to dry on the floor. Bush beans are generally allowed to mature on the vine, then the whole plant is pulled and allowed to cure much like hay. After thorough curing the beans are thrashed out and stored in bags hung in a dry place. Sweet potatoes can be kept fairly well in a mound, but a warm, dry place is preferable. In all the methods of mound storage detailed it should be remembered that where the temperature is likely to fall to zero F. or below, the covering of earth and straw will need to be built up to a somewhat greater thickness than that indicated, perhaps a foot or more in the colder climates. If loose earth tends to wash off the mound, cover it with roll roofing or sisal paper.

Garden-Hose Nozzle From Can

If you need a nozzle for a garden hose and are unable to buy one, a good substitute can be made from a beverage can of the type that has a narrow neck. Just solder a pipe coupling to the neck of the can and screw it on the hose. Punch several tiny holes in the can, the number being determined by the spraying stream desired when the water is turned on.



Sturdy Garden Wheelbarrow Is Easy to Make



In case you need a wheelbarrow and your dealer has nothing in stock, you will find it an easy matter to make a serviceable barrow yourself, using odds and ends of lumber and some barrel staves. By following the construction shown, the chassis will be exceptionally rigid, two carriage bolts being used at each joint where two frame members cross each other. The staves will fit together snugly when screwed to the main frame and handle members, if the edges of the staves are trimmed straight as shown in the detail. This can be done while the staves are clamped to a board. The wheel consists of four layers of wood; two center layers nailed or screwed together with the grain running at right angles, and the side pieces, cut in segments to form a wide rim. The hubs are made up of blocks. A hole is drilled through the exact center of the wheel to take a length of $\frac{1}{2}$ -in. pipe, pref-

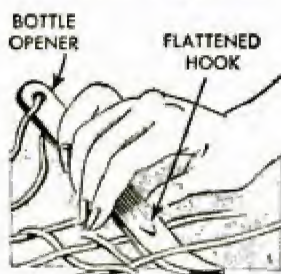
erably brass, which serves as a bearing for a $\frac{1}{2}$ -in. iron bolt. After running two nuts to lock each other on the threaded end of the bolt, the extending end is cut off. If desired, the open sides of the barrow, which permit easy dumping of a load, can be closed by means of improvised side pieces, triangular in shape. These are held in position by means of pins driven into their lower edges to fit small holes drilled through the staves. The pins may be heavy nails with the heads cut off. Although not necessary, the appearance of the barrow can be improved considerably by applying a couple of coats of paint.

Dipping Coated Pictures in Ink Produces Reverse Silhouettes



Pictures in reverse silhouette—the figure or subject being white, and the background black or other color—are novel and interesting to make. The work is accomplished by first lightly outlining the picture with a soft-lead pencil, after which showcard white, which is soluble in water, is applied to all portions that are to remain white, using a fine brush or both a brush and a pen. After this has dried, the card is dipped in a waterproof India ink or a waterproof color, using a shallow tray just large enough to take the card. By dipping the work, the background will be covered more uniformly than is generally possible by using a brush. When the background is dry, the showcard white is washed off under a stream of cold water, leaving the outline sketch in sharp printlike contrast. If any of the pencil lines can be seen, a soft sponge-type eraser is used to remove them after the card has fully dried from the water bath.

Bottle Opener Serves as Rug Needle



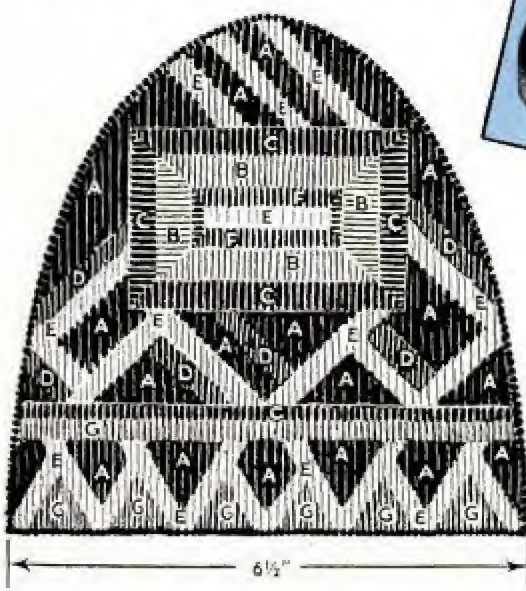
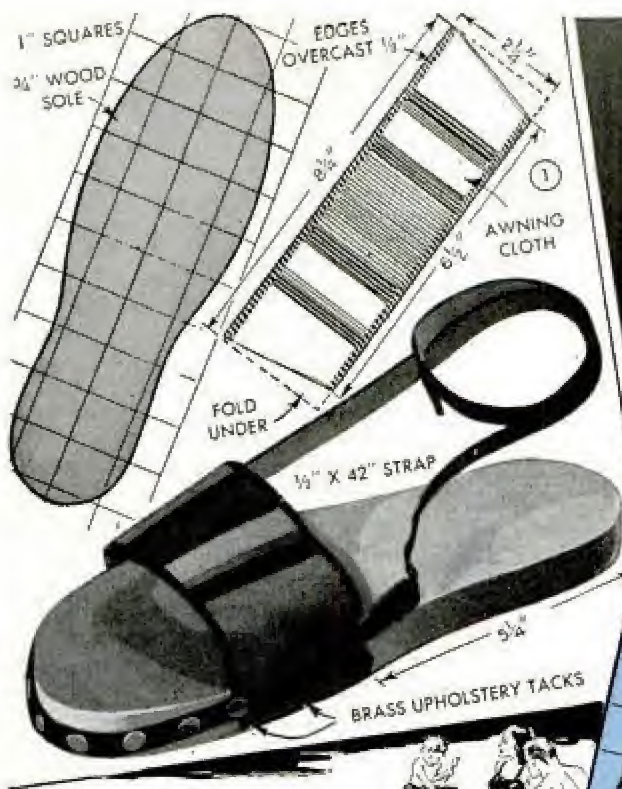
A needle for weaving rag or rope rugs can be made from a bottle opener of the type shown. The projecting hook to slip under rims of tin cans is hammered down flush. The rag or rope is inserted through the hole originally provided as a means of hanging the tool on a nail.

Colorful Beach Sandals of Wood, Canvas and Raffia

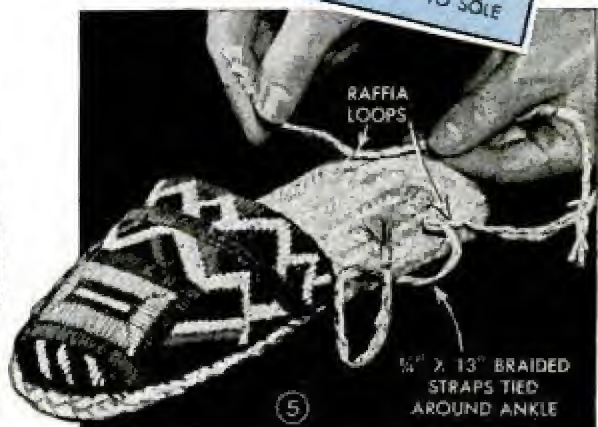
Initialed or appropriately monogrammed, a pair of these novel sandals will personalize your beach wardrobe. Of the three styles given on the opposite page, the open-toe style shown in Fig. 1 is the simplest to make. It has a wooden sole, an upper of brightly striped awning material, and is smartly studded at the toe with ornamental tacks. Individual sole patterns can be had by outlining the foot on paper and cutting the wood accordingly. First the edges of the canvas should be overcast with strong linen thread. Then each end is creased and folded under for tacking to the sole with large-head upholstery tacks. To hold the sandal to the foot, a long strap is provided, this being crossed behind the heel, brought around and passed through a buckle in front. The strap is fastened with tacks, 1-in. apart, Fig. 2.

The soles of the sandals shown in Figs. 3 and 5 are formed of $\frac{3}{8}$ -in. braids of natural-colored raffia. This is done by sewing the braided strands temporarily to heavy wrapping paper within the outline of the sole pattern. Starting at the center of the pattern, the braid is coiled around and around in rows, each adjoining row being stitched to the preceding one. When the sole area of the pattern has been filled in, the outer edge is overcast with raffia and the paper is peeled off the bottom.

Choice of two styles of uppers for the braided soles is given in Figs. 3 and 4. One makes use of net filet material through which colored raffia is interwoven in a diagonal pattern such as shown, or with initials or monogram. The toe piece shown in Fig. 4 is likewise woven over a piece of mesh material having about 14 squares per inch. Here, the edges are overcast first, then you weave the rectangular portion of the pattern, starting with the outer border. After this, the diagonal strips are marked with pencil and filled in with the colors indicated. The toe piece is sewed to the sole and ties of braided raffia are attached 2 in. from the heel.



A-BLACK B-PINK C-RED D-GREEN
E-NATURAL F-BLUE G-VIOLET



Colorful BEACH SANDALS

Heel Used as a Steering Fulcrum On Child's Coaster Wagon

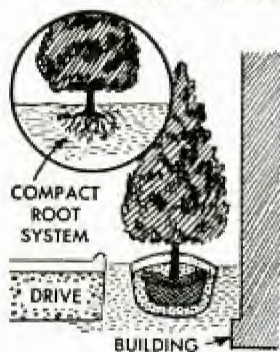


After a child had been injured on the steel "Y," attached to the front of his coaster to serve as a steering fulcrum for the handle, one father replaced it with a notched rubber heel. The rubber is stiff enough to serve the same purpose as the metal fulcrum but does not offer the same opportunity for injuring the driver.

Preventing Corrosion on Posts Of Car Storage Battery

If the posts and terminals of your storage battery have a tendency to corrode badly, apply a mixture of baking soda and gear or cup grease mixed in the proportion of one-third soda and two-thirds grease. Keep a good coating of the mixture on the parts. Applications applied once or twice a year, or each time the battery terminals are removed will be sufficient. If connections between the posts and terminals are not kept clean, a resistance to the passage of current is set up, and motor operation is impaired, especially during cold weather.

Selecting Trees for Planting In Narrow Places



When selecting a tree for transplanting to a location where the roots will be unable to spread over a large area, choose one that has been transplanted from two to four times previously. Such a

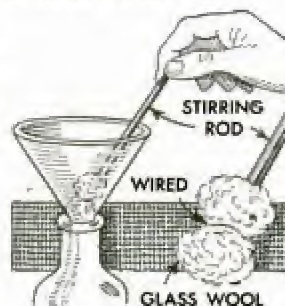
tree will have developed a compact and strong root system, enabling it to adapt itself to restricted quarters more readily than one with widely spaced roots.

—J. Modroch, Danbury, Conn.

Corrosive Acids Filtered Safely Through Glass Wool

Where it is necessary to strain dirt or sediment from corrosive acids, a small piece of glass wool will serve as a satisfactory filter. In case a funnel is used to facilitate pouring such acids into bottles at the

same time, it's a good idea to attach the wool to the end of a glass stirring rod with copper wire so that it can be inserted or removed from the funnel easily.



Fountain Pen 'Irons Out' Creases In Carbon Paper



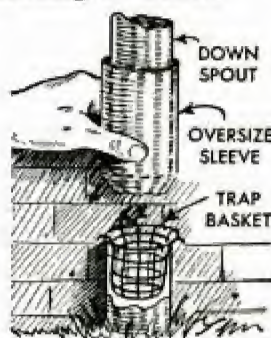
It is not necessary to discard a good sheet of carbon paper simply because it has been creased when wrinkled between two or more sheets in a typewriter. All you need to do is place the paper, carbon side up, on

a smooth surface and "iron out" the creases with the blunt end of a fountain pen.

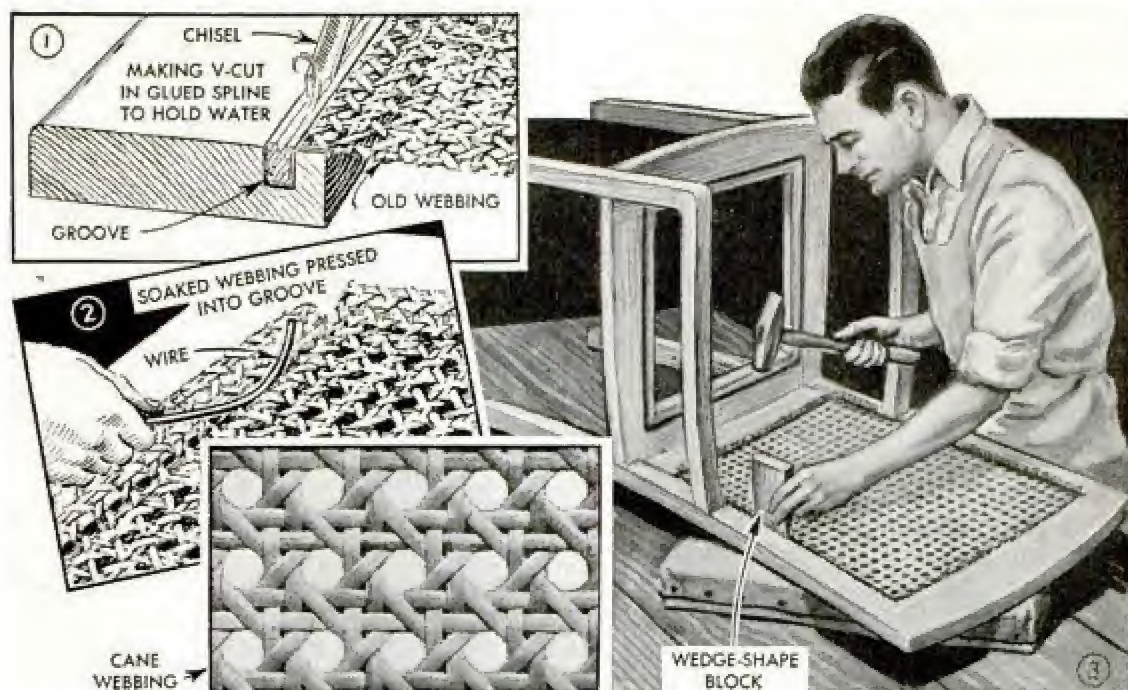
Leaf Trap in Downspout Cleaned Without Climbing to Roof

To get away from the necessity of using a ladder to clean the screen on my downspout, which leads to a cistern, I fitted the spout with a wire trap basket at ground level. This was installed by cutting a section from the downspout and dropping the basket in place, after which an oversize sleeve was bent and used to connect the spout.

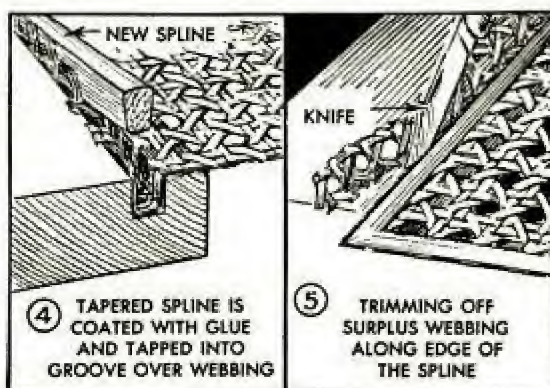
—George B. Grimm, Flushing, N. Y.



Replacing Woven Cane Webbing in Furniture



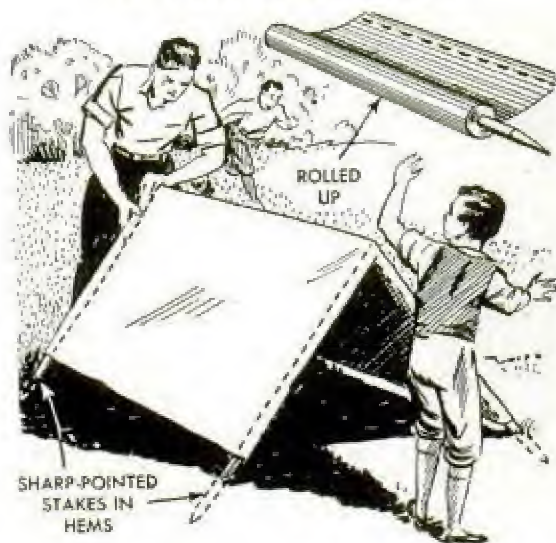
On furniture fitted with prefabricated cane webbing—not the hand-woven caning—it is sometimes necessary to replace the webbing, which may seem quite a difficult job, but is really quite simple if the cane spline that holds the old webbing in place is removed properly. Usually this can be done by softening the glue with water. With a V-shaped chisel cut a groove in the surface of the spline, Fig. 1, to retain water, which is applied and left to soak overnight. It is best to have the spline in a horizontal position so that the water will not run out of the V-cuts. Water may have to be applied several times before it has soaked through and softened the glue, allowing no time between applications for the spline to dry out. When ready to remove the spline, pick it up at the end with a sharp-pointed tool and then pull it out, after which the webbing comes out easily. A new piece of webbing, which is available in four different sizes of weaving, can be obtained from upholstering-supply houses. To match the old webbing, send a piece along with your order. The new piece must be soaked in water for an hour or so before using it so that when it dries and shrinks after installing, it will be drum tight. Also, soaking is necessary to permit bending the edges into the groove, which can be done by means of a piece of heavy wire shaped as shown in Fig. 2. After pressing the edges into the grooves, so that the webbing is reasonably taut, glue is applied to a new reed spline,



obtained at the same time you get the webbing. These come in various widths, so be sure to duplicate the old one. You will notice that it is tapered. After applying a sufficient amount of glue, the narrow edge of the spline is tapped into the groove over the webbing as shown in Fig. 4. A small block to take the hammer blows as in Fig. 3, will prevent marring the spline. The ends should be mitered at the corners so that they will butt together snugly. After the glue has dried, you cut off the ragged edge of the webbing on one edge of the spline with a sharp knife, as in Fig. 5. When the webbing has dried out thoroughly, you can proceed with finishing.

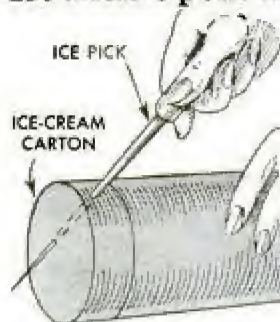
When using pine cones and branches of trees for indoor decorating, they can be painted white easily with liquid shoe cleaner, which gives them an attractive dull finish that dries rapidly.

Pegless Sun Tent Erected Easily In Yard for Children



To avoid any possibility of a small child being injured by falling over pegs used to support a play sun tent, stitch hems in the ends of the cloth to receive four pointed sticks so that the tent may be erected as shown. The absence of both center poles and pegs makes such a tent especially suitable for small children. It is easy to erect or take down, and takes very little space when rolled for storage.

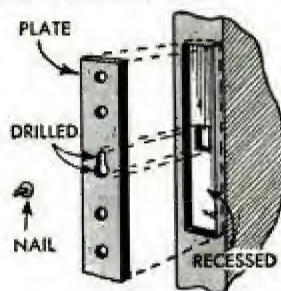
Ice Pick Opens Ice-Cream Carton



The next time you have to remove the cover from a cylindrical cardboard carton of ice cream, and it is difficult to slip off, try the following: Just insert an ice pick through the cover as indicated and pry upward. This will force the cover off the container neatly and with very little effort.

Wall Shelves Are Hung Neatly By Concealed Brackets

After completing several wall shelves and searching without success for ready-made hardware to hang them so that nails would not show, I used the arrangement indi-

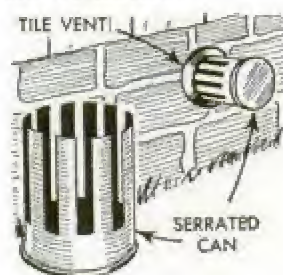


cated. This involves recessing the back edges of the shelves to receive drilled metal plates with tapered openings in the center to accommodate nails on which the shelves are hung. Note that each side must be mortised behind the slot in the plate to provide room for the nail heads.

—P. J. Moulds, Ottawa, Ont., Can.

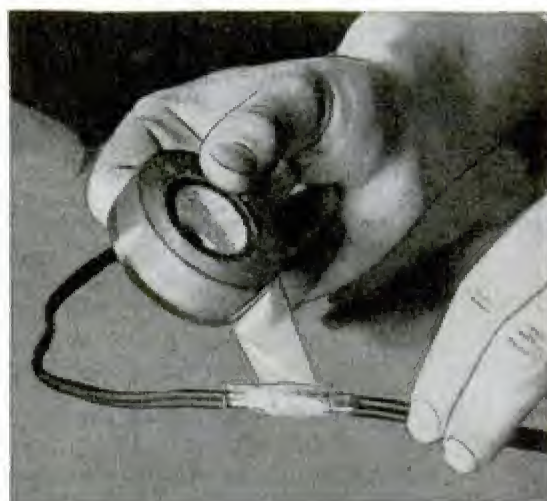
Serrated Can Covers Tile Vent During Cold Weather

Where farm buildings are constructed without a basement and tile vents are provided in foundations to prevent dampness and rotting of floors, it is often advisable to fit covers over the vents to close them in extremely cold weather.



In one case, a farmer found that serrated tin cans were ideal for this purpose as they can be adjusted quickly to provide ventilation when necessary.

Cellulose Tape Prevents Breaks In Lamp-Cord Insulation



Breaks in the insulation of a lamp cord due to bends where it hangs over the edge of a table or is suspended from a wall outlet, can be prevented by wrapping the cord at these points with cellulose tape. This stiffens the cord in much the same way that a spring stiffens the hose of a sprayer or other similar appliance.

¶ To remove oil and water from the bottom of a motorboat, toss in a liberal amount of sawdust to soak up the oil and water, after which the sawdust can be scooped out with a trowel or other suitable tool.

Make your own PELORUS

Homemade navigating instrument for taking accurate bearings on small boats. Also useful to detect error in ship's compass. Heavy pendulum weight keeps unit steady and sighting vanes in line with eye



①

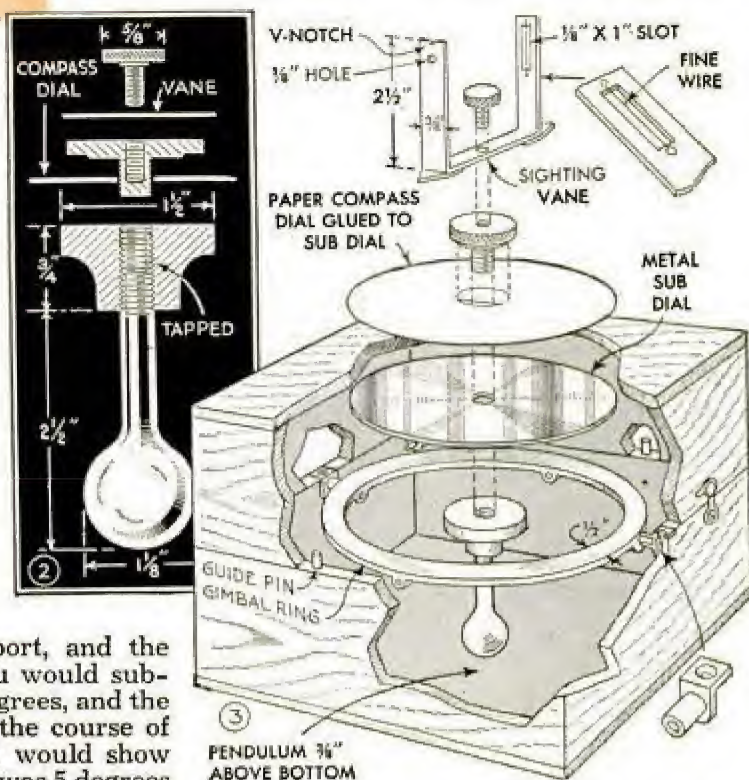
By W. E. Phillips

ACCURATE enough for use on small boats, this pelorus can be built at negligible cost. With it you can measure angles in a horizontal plane off the ship's head. As an example of its use, assume that an object is sighted through the pelorus, and the ship's compass is read at the same time by the helmsman. If the pelorus reads 47 degrees to starboard, and the ship is on a course of 61 degrees, the object bears the total of the two readings, or 108 degrees per ship's compass. If the object was sighted to port, and the reading was 304 degrees, you would subtract this reading from 360 degrees, and the difference (56 degrees) less the course of the ship's head (61 degrees) would show that the bearing of the object was 5 degrees per ship's compass.

Brass is best for all the working parts, although, if difficulty is had in obtaining pieces large enough for the sub-dial and gimbal, these two parts can be turned of hard-pressed board. Avoid using steel, as it may influence the ship's compass during the process of swinging ship, and thereby make the results less accurate. The size of the parts depends on the size of the compass card used. The larger this is the more



The photo above shows the pelorus used in a sailboat, the pelorus being placed even with the edge of the cabin, which is square with the fore-and-aft line of the boat

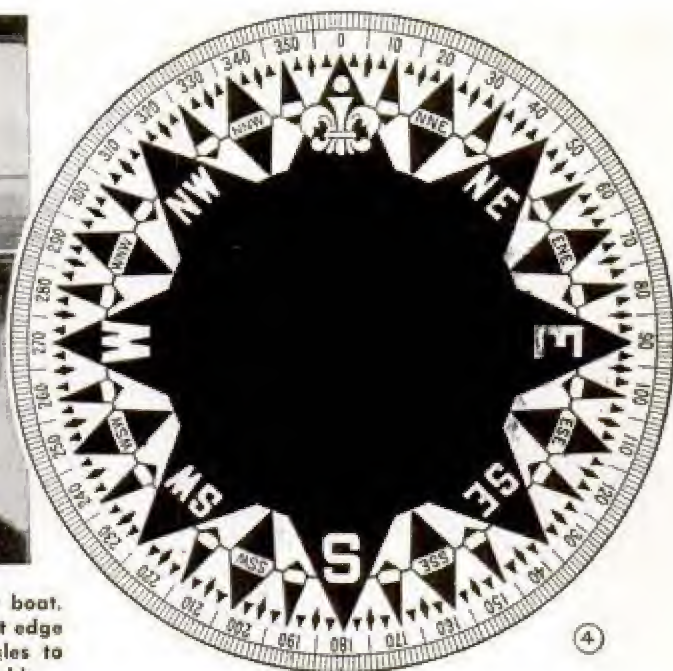


③
PENDULUM 3/4"
ABOVE BOTTOM

accurate the pelorus will be. The one shown in Fig. 1 has a 6 3/4-in. dia. card and a pendulum of the size given in Fig. 2. An etched dial of metal is preferred, but in case you cannot obtain one, the pattern shown in Fig. 4 can be photographed and then enlarged on glossy paper to whatever size you want, after which it can be glued to a sub dial. The drawing in Fig. 3 shows the order of assembly of the various parts.



Here the pelorus is being used on a motor boat. In this case the box is aligned with the front edge of the chart table, which is at right angles to the fore-and-aft, or lubber line of the ship



Two $\frac{1}{8}$ -in. pins, which pivot the sub-dial inside the gimbal ring, are soldered to the underside to extend beyond the edge at points 0 degrees and 180 degrees on the dial. Likewise, the gimbal ring is fitted with pins located at points 90 degrees and 270 degrees, or at exact right angles to the sub-dial pins. The accuracy of the instrument depends on the care used in locating the pins exactly. If they are not diametrically opposite each other at the points specified, the dial will not balance and will float with a permanent list. It should swing freely. The sub-dial pins are carried in small V-shaped bearings soldered to the underside of the gimbal ring, while the bearings that carry the gimbal-ring pins consist of right-angle hangers having small pieces of tubing soldered to them. A clearance of $\frac{3}{16}$ in. is about right between the dial and the gimbal ring, while about $\frac{1}{2}$ in. should be allowed between the ring and the box in which it is installed.

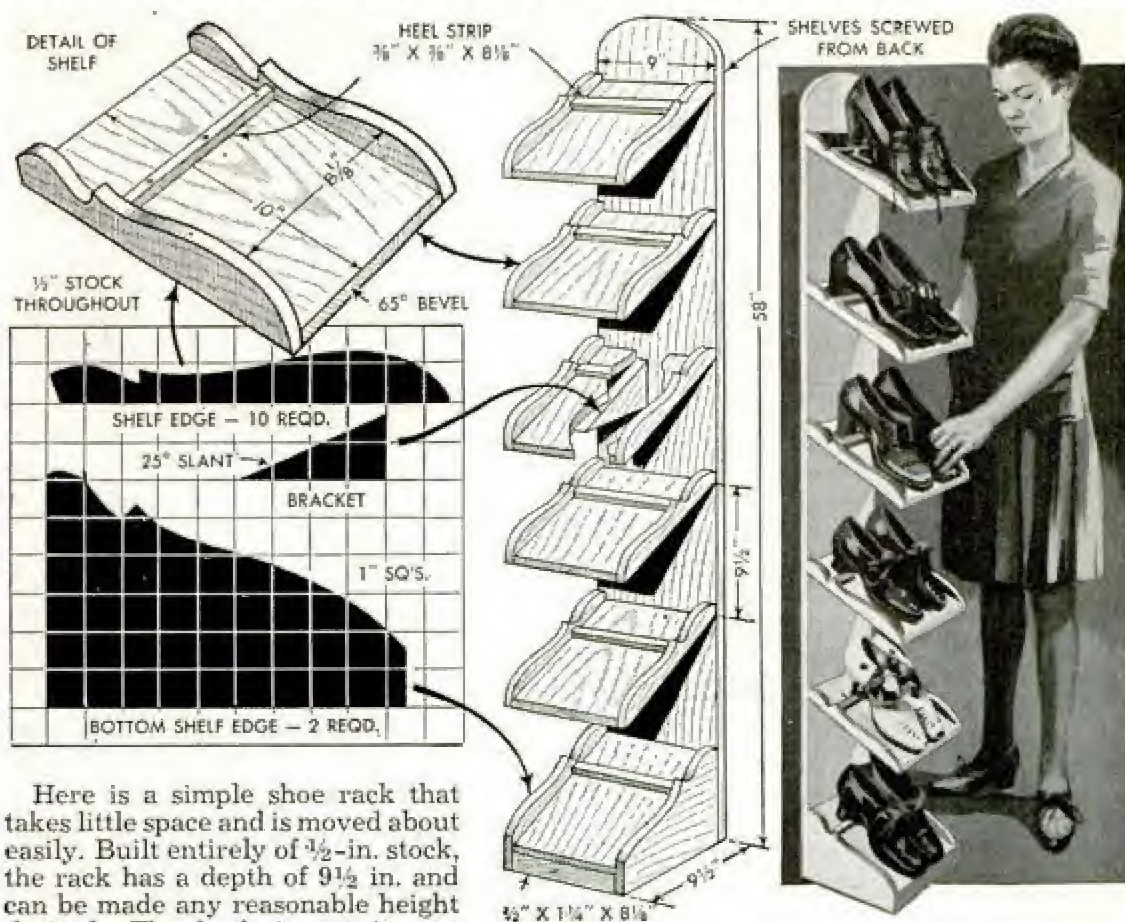
The sighting vane comes next. This consists of a $\frac{3}{8}$ -in. brass strip bent to a U-shape and having a pointer soldered to each end as shown. The pointers should extend just to the row of graduation marks on the compass card and should be bent downward slightly to just clear it when the vane is rotated. Both the sighting hole and the V-notch directly above it must be in exact alignment with the pointer at one end. Likewise the fine wire soldered across the slot in the opposite side must be in line with the pointer below it. The two-part screw, which holds the vane to the dial and the dial to the pendulum, is provided with knurled edges to permit tightening with

the fingers, and a shoulder is cut on the underside of each part. Note that the hole in the sub-dial is drilled to fit the screw shank, while the one in the paper dial is cut to fit the shoulder of the screw. The top part of the screw should be tightened sufficiently to allow the vane to be turned easily, but without excessive play. The attaching hole in the vane should fit the shoulder on the underside of the top screw.

The box in which the pelorus is mounted should be deep enough to allow a $\frac{3}{8}$ -in. clearance for the pendulum. The top half, or cover, is made exactly like the bottom half, and both are held together with a couple of flat hooks of the type shown. Note that pins are provided in the edge of the cover to keep the two parts of the case in alignment. The gimbal bearings are mounted in the exact center of opposite sides of the box with a single screw.

As an aid to setting the compass dial, scribe a fine line across the gimbal ring at 0, 90, 180 and 270 degrees, which will indicate the center lines of the bearing pins. Normally, the dial will be set to these lines, which will correspond to the lubber lines of the ship's compass. For some purposes, such as when swinging ship to correct the compass, it is desirable to preset the pelorus to a definite course and then read the bearing of an object when the ship is on that course. To preset it, loosen the dial screw, rotating the dial to the desired heading, taking the gage from the lubber line scribed on the gimbal ring, and then retightening the screw. Bearings taken with the pelorus set in this way, correspond to direct readings of the compass itself.

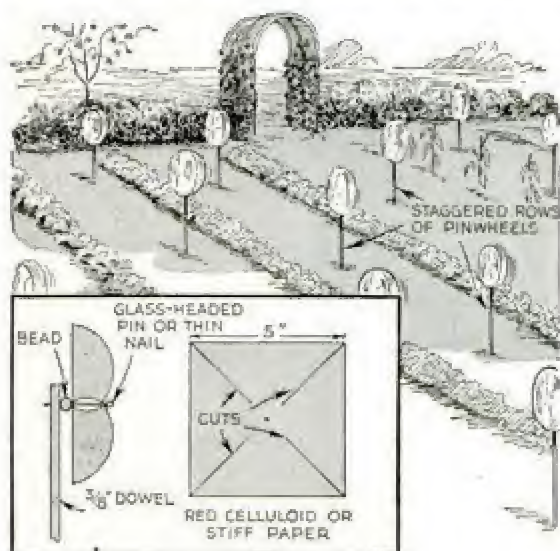
Portable Shoe Rack Takes Little Closet Space



Here is a simple shoe rack that takes little space and is moved about easily. Built entirely of $\frac{1}{2}$ -in. stock, the rack has a depth of $9\frac{1}{2}$ in. and can be made any reasonable height desired. The back is cut in one piece, and the shelves are attached with flat-head screws. Each shelf is braced with a bracket located inconspicuously under it, and the strip over which the shoe heels are hooked is attached with brads or with

screws driven from underneath. Finishing nails are used to attach the sides to the shelves. Notice that the bottom shelf also serves as a base for the rack and has deeper sides than the other shelves.

Colored Pinwheels in Your Garden Scare the Birds Away



If birds are damaging your vegetable garden, try using a number of pinwheels mounted on stakes set in the garden. Movement of the wheels plus the noise they make has been found highly effective in scaring away birds. Use several rows of the wheels and stagger them in the rows. You can make the wheels by cutting squares of celluloid or stiff, waterproof paper as shown in the lower detail. Glass-headed pins or thin nails pushed through the wheels and into the stakes will serve as axles, and small beads between the wheels and stakes act as thrust bearings.

¶ In selecting plans to build a chest or bookcase, it's a good idea to keep in mind that any piece of furniture having 5 or 6 in. of open space under it will provide room for a broom or dust mop to be used.

Envelopes and Index Cards Typed At the Same Time



In offices where both envelopes and index cards are typed, much time and work can be saved by using the illustrated method, which permits both of them to be typed at the same time. To do this, insert into the envelope the index card and a piece of carbon paper of the same size, as shown. Then type the envelope in the regular way and the carbon will make an imprint on the card, thus saving one typing operation.

Portable Loading Chute on Truck Uses Endgate for Ramp

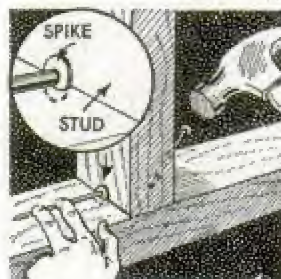
Time wasted in looking for a suitable place to load livestock on farms where regular chutes are not available is eliminated entirely by one truck driver who



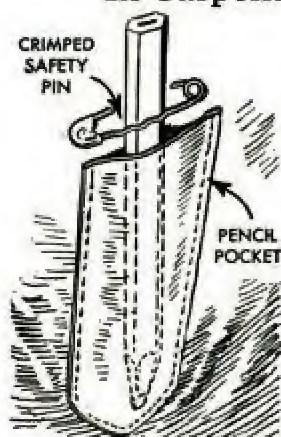
assembled a chute that can be carried on his truck at all times. This was done by hinging a portion of the rear endgate so that it dropped down to form a ramp, after which detachable sides were built to fit the ramp; stake pockets being used to hold them in place. When not in use, the sides are carried under the truck bed.

Studs Toenailed Without Slipping

One home owner, in constructing the framework of a small building, experienced some difficulty in holding the studs in position while toenailing them. To overcome this trouble, he merely drove the side of a spike head into the plate, which provided a temporary stop to prevent the studs from slipping. When actually toenailing these pieces, the spike was held with the fingers or foot, depending upon the position most convenient.



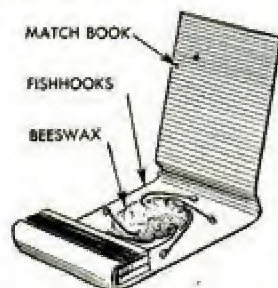
Crimped Safety Pin Holds Pencil In Carpenter's Pocket



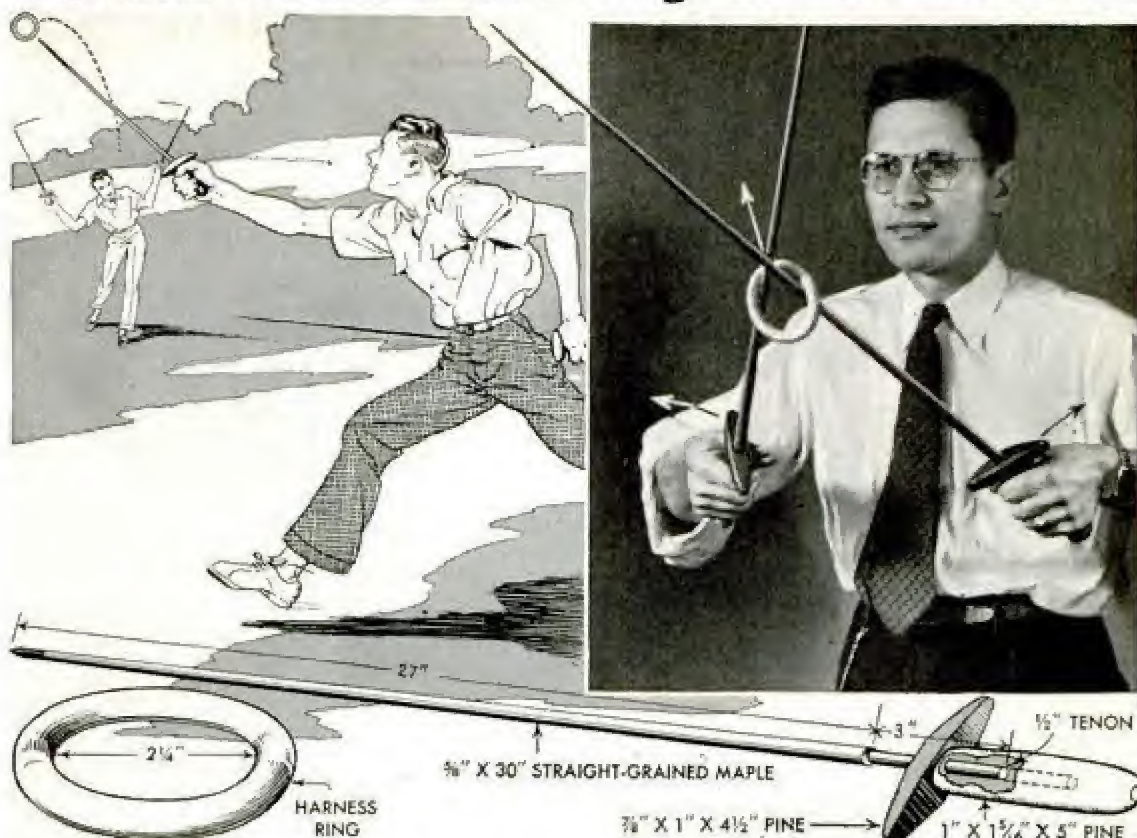
To avoid loss of his pencil from his overall pocket, one carpenter crimped a safety pin so that the flat pencil would fit snugly in it when closed. The pin was attached to the fabric just above the pencil pocket, so that the pencil could be inserted or withdrawn easily.

Beeswax Holds Small Fishhooks In Empty Match Book

A handy and safe way of carrying small fishhooks in your pocket is to keep them in an empty match book. To do this, stick a small wad of beeswax inside of the match book as indicated, then insert the barbed ends of the hooks into the wax and close the cover.



Wooden Swords Shoot Rings in Unusual Game



Shooting and catching celluloid or plastic harness rings with amazing speed over distances up to 100 ft., each player of this novel game uses a couple of wooden "swords," holding one in each hand. When two persons are playing, one ring is used, but when there are three or more players, two or three rings can be used, depending on the players' ability to keep them in the air. Two persons learning the game take positions facing each other, about 25 to 75 ft. apart. The game is started by dropping the ring on the ground at the shooter's feet, after which he places the points of both swords inside the ring. Then, by simply crossing the swords, keeping the tips inside the ring, it will slide up the blades toward the hilts. The ring is shot by reversing this process—pulling the handles of the criss-crossed swords apart quickly as shown in the photo, forcing the ring off the tips.

For best results in shooting the ring, the following technique should be observed: With the ring over the criss-crossed swords near their hilts, hold the right hand sword over the left-hand sword, spreading them apart up and down as much as possible within the limits of the ring. Next, take aim so that one sword points toward one side of the opponent and the second toward the other side. Then, with a quick spreading movement of the arms, in a horizontal

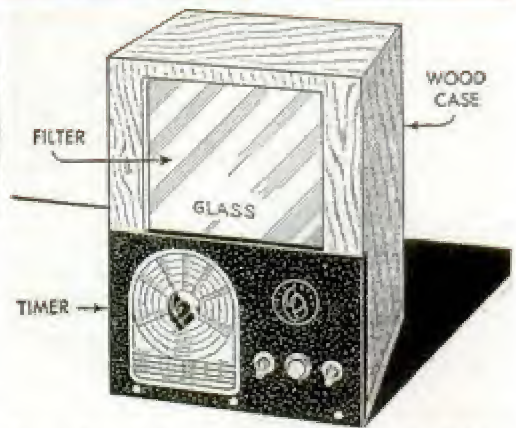
plane, force the swords apart, which shoots the ring. Spreading of the arms must be done as smoothly and as uniformly as possible, always keeping the swords apart up and down as this causes the ring to rotate while traveling through the air, with the opening toward the opponent so he can impale it. More "pull" on one sword than on the other will cause the ring to go off at an angle. Also, if the swords are not held apart up and down as much as possible while uncrossing them, the ring will not rotate but will wobble toward either side so that it cannot be caught easily.

Beginners should start with a large ring such as a crossover ring for a double harness, but after some skill is acquired, a smaller ring will be found most satisfactory. Catching it requires no rules and depends entirely on the skill developed. Scoring may be done by counting a catch only when the opponent also catches the ring on the return shot. This method prevents a player from scoring a catch and then returning the ring out of the opponent's reach to prevent him from scoring.

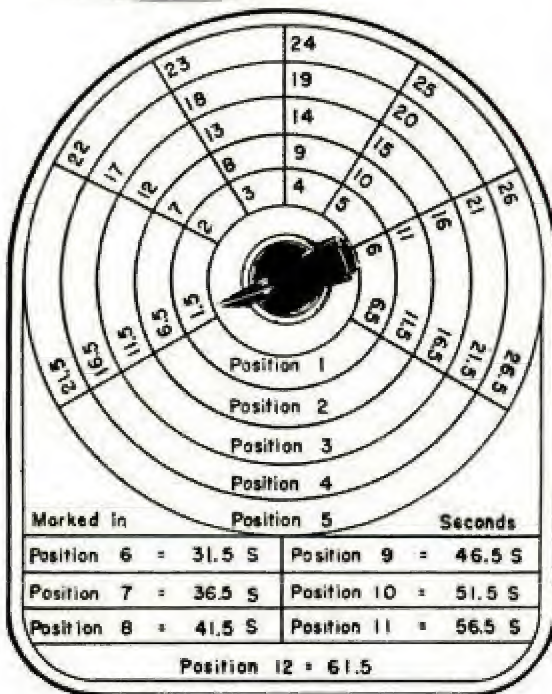
The swords may be made from 3/8-in. maple dowels, tapered to about 1/4 in. at the tips, and set into comfortable handles. The surfaces of the swords should be tapered evenly, sanded smooth and waxed.

—W. J. Daggers, Snyder, N. Y.

PHOTO-PRINT TIMING

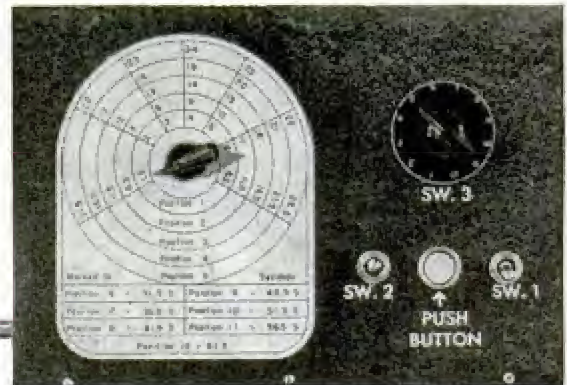


The timing unit may be incorporated in a safe light as shown above, may be combined with a contact printer, or housed in a cabinet and placed near a printer or enlarger



By Arthur I. Rattray

OF GREAT value to any photographer for controlling the time of exposing prints, when using either an enlarger or a contact printer, this automatic electronic timer gives accurate control between 1.5 and 61.5 seconds. Its greatest usefulness lies in exact timing of large numbers of duplicate prints, in which case printing time can be cut down to a minimum if the illumination in the enlarger or printer is



increased proportionately. For color-separation work, the timer is also of special value, although any photographer will find it a great convenience in his daily work as it eliminates inaccurate counting and permits him to attend to other details in the darkroom while a print is being exposed. The timer is designed to operate on 115-volt, alternating current, and will control a lamp or electrical appliance that does not exceed a consumption of 250 watts. Being small in size, it may be housed in a cabinet or set on a shelf near the enlarger or printer, although it may be incorporated with a printer or with a safe lamp.

In use, the timer is plugged into a convenient outlet, and the enlarger or printer is connected to the timer. After these connections have been made, you can throw in switch No. 1, which lights the tubes and also the lamp of the enlarger or printer. As soon as the tubes have been warmed up, the lamp in the enlarger or printer will go off automatically provided it is not kept on by switch No. 2, which is used only to turn on the enlarger or printer lamp while

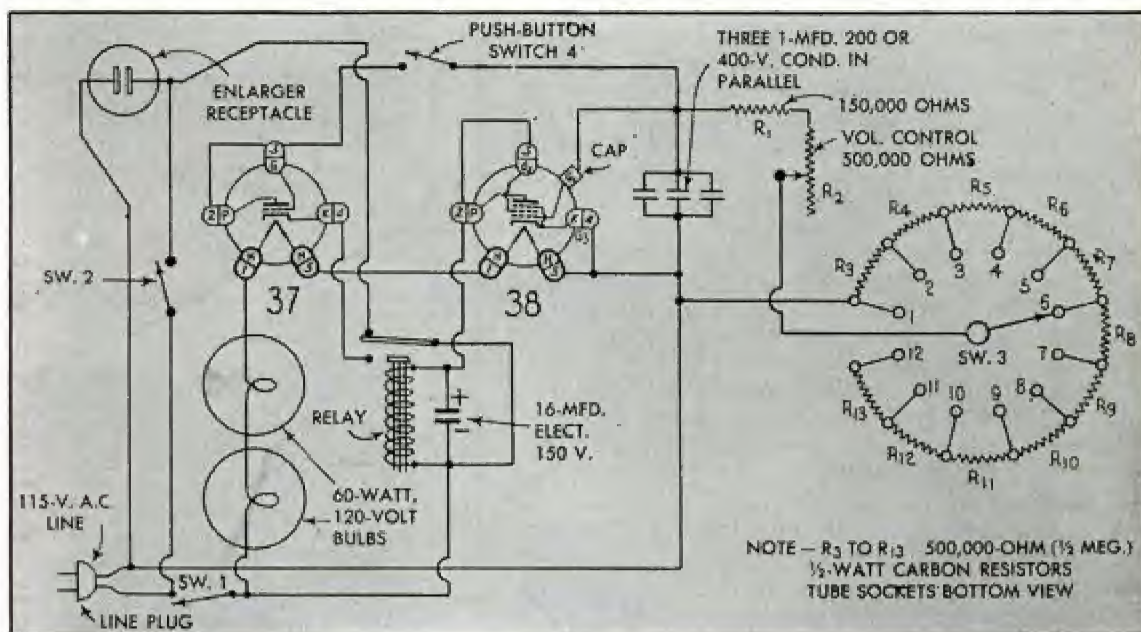
the Accurate Way

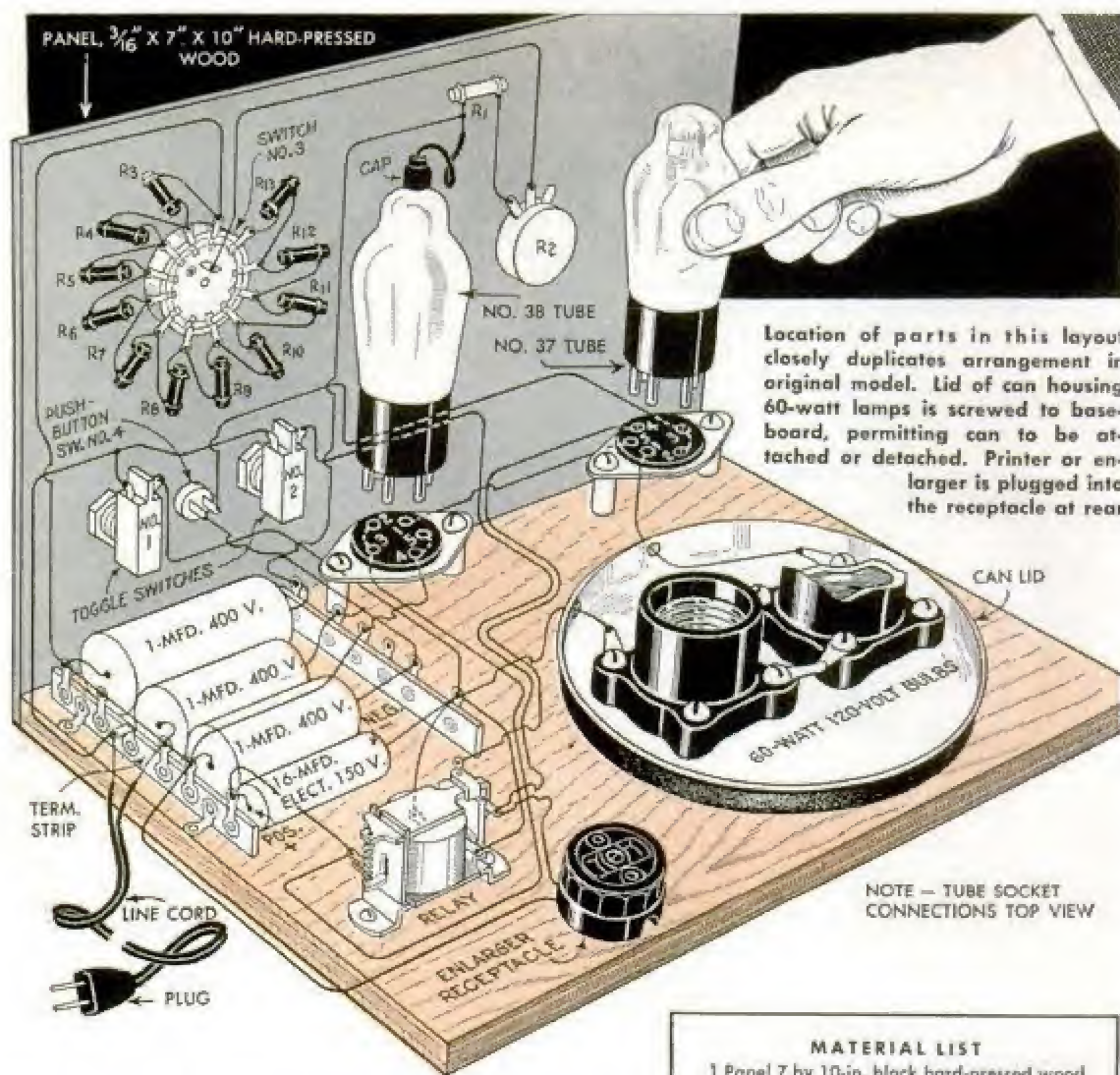
Homemade electronic control unit automatically turns out light of enlarger or contact printer. Timing of prints can be varied within fractions of seconds from a 1.5- to 61.5-second exposure. Saves valuable time when making large numbers of duplicate prints, and aids in color-separation work



focusing and arranging negatives or paper. Adjustment of the timing period is made by means of two variable controls, one centered on a paper dial and the other (switch No. 3) centered over a disk numbered from 1 to 12. These two controls work in conjunction with each other. When switch No. 3 is set in position 1, you get any variation of timing between 1.5 and 6.5 seconds. When switch No. 3 is advanced to position 2, the time period ranges from 6.5 to 11.5 seconds, etc. Position references on the

dial refer to positions of switch No. 3. Assuming that you wish a timing period of 3.5 seconds, you put the pointer of the dial halfway between 3 and 4, and set switch No. 3 on position 1. Then you press the button, which turns on the enlarger or printer lamp for exactly 3.5 seconds. Similarly, suppose you wish a timing period of 22 seconds, you set the dial pointer toward 22, right on the line, and switch No. 3 in position 5, before pressing the push button. When finished using the timer, turn off





toggle switch No. 1, assuming that toggle switch No. 2 (used only for focusing, etc.), is off.

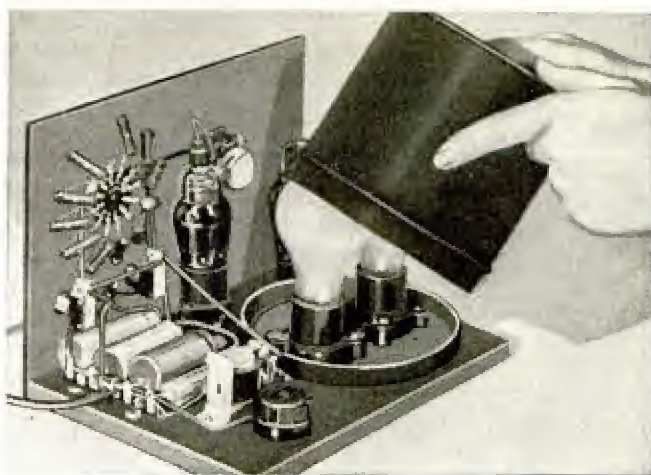
The cost of parts needed to build the timer did not exceed \$10 at the time this article was prepared. Two 60-watt Mazda lamps provide the necessary voltage drop to light the heaters of the No. 37 and No. 38 tubes. A large tin can houses the lamps so that the unit can be used safely in the darkroom. If the timer is incorporated with a safe light, the two lamps can be used for illumination in the safe light. If the timer is put in a cabinet, you may dispense with the tin-can light shield, but if it is incorporated in a printer, you use either the light shield or install a partition between the timer unit and the printer lamp to prevent accidental spoilage of paper. Three 1-mfd., 200 or 400-volt tubular capacitors of good quality are used in conjunction with a resistance of 6 megohms to make up the timing discharge circuit of 61.5 seconds. If the eleven 500,000-ohm resistors, R_3 to R_{13} are of close tolerance, your dial will line up like the one of the writer; if not, your calibration may look slightly different. It will be only a coincidence if

MATERIAL LIST

- 1 Panel 7 by 10-in. black hard-pressed wood
- 1 Baseboard $\frac{1}{2}$ by 7 by 10-in. plywood
- 1 Tin can to house two lamps
- 2 60-watt, 120-volt Mazda lamps
- 2 Clear receptacles for lamps
- 1 Lampcord
- 1 Plug
- 1 Plug receptacle
- 3 1-mfd., 200 or 400-volt tubular capacitors
- 1 16-mfd., 150-volt, elect. cond. (see text)
- 1 150,000-ohm, $\frac{1}{2}$ -watt resistor, (R_1)
- 1 500,000-ohm, linear taper variable control carbon resistor, (R_2)
- 11 500,000-ohm, $\frac{1}{2}$ -watt resistors, (R_3 to R_{13})
- 1 Relay, s.p.d.t., plate-current type
- 2 Toggle switches, s.p.s.t., panel type, (S_1 and S_2)
- 1 Pushbutton switch, push to close, (S_3)
- 1 12-point rotary selector switch, (S_4)
- 1 Switch plate marked 1 to 12
- 2 5-prong sockets
- 1 38-tube
- 1 37-tube
- 1 Grid cap for 38-tube
- 2 Tie-point terminal strips (6 Lug Type)
- 2 Knobs, $1\frac{1}{4}$ in.
- 4 Spacers for tube sockets, $\frac{3}{4}$ in. high
- 2 30-in. lengths spaghetti tubing
- 3 24-in. lengths No. 14 bus bar
- 12 1-in. No. 6 r.h. wood screws
- 6 $\frac{1}{2}$ -in. No. 5 r.h. wood screws

your dial turns out to be a duplicate of the one shown. Be sure to use a linear-taper, 500,000-ohm volume-control resistor, R_2 , or the dial reading will be bunched at one end of the dial. To prevent relay chatter, a 10, 12 or 16-mfd., 150-volt electrolytic condenser is placed across the winding. The relay, of the plate-current type, has a coil resistance of about 2,500 ohms and actuates a single-pole, double-throw switch. As this is the only item that may be hard to get, you might have to improvise one from a low-voltage relay having a s.p.d.t. switch and a removable solenoid. Unwind the heavy wire and rewind with fine wire about No. 40-ga., which you can salvage from an old 3-to-1 audio transformer. Wind the wire closely and as full as possible.

The relay windings are in the plate circuit of the No. 38 tube, which, when heated up, draws plate current and closes the relays. Then the rectifier circuit of the No. 37 tube is completed, and the unit is ready for operation. During the warm-up period, the enlarger or printer lamp will light but as soon as the initial warm-up period is complete, it will go out automatically. When the push-button switch is pressed, the rectified voltage from the No. 37 tube charges the three paralleled 1-mfd. condensers. This puts a high negative bias on the control grid of the No. 38 tube, reducing its plate current immediately to the point where the relay drops out. The time required for the plate current to build up again to the point where the relay is actuated, is the timing period of printing, which



varies according to the amount of resistance shorted across the condensers. A high resistance causes a long time period, and vice versa. Resistance R_1 should be incorporated in your timer as shown, or damage will be caused to the No. 37 tube.

After you have built up your timer, you are ready to calibrate it. Place a piece of paper in position under the pointer of R_2 , so that you can mark in pencil where the various seconds fall on your dial while operating the unit. By successive and repeated operations and markings you will gradually find out where the various seconds come in on your dial scale. This is a somewhat tedious procedure, but once accomplished, it is very satisfying to know that from then on all you have to do is to select the time desired, press the push button, and the timing will be accurate. The writer used a large kitchen clock with a sweep second hand and had very little difficulty in calibrating.

Camera Case Steadied by Belt While Climbing or Hiking



Hikers who like to take along their camera will welcome this suggestion to keep the camera case from swinging and bouncing around while they are traveling over rough ground. A leather loop is riveted to the back of the case and the belt is slipped through it. This holds the case firmly, yet allows easy removal of the camera.

Hold Films in Front of a Fan While Brushing Off Dirt

When a camel's-hair brush is drawn across a negative to remove dust, static electricity may be created, which will draw a deposit of dust to the opposite side of the film. I always brush negatives directly in front of an electric fan, which blows away this dust, as well as that removed by the brush.—C. C. Caswell, Clarinda, Ia.

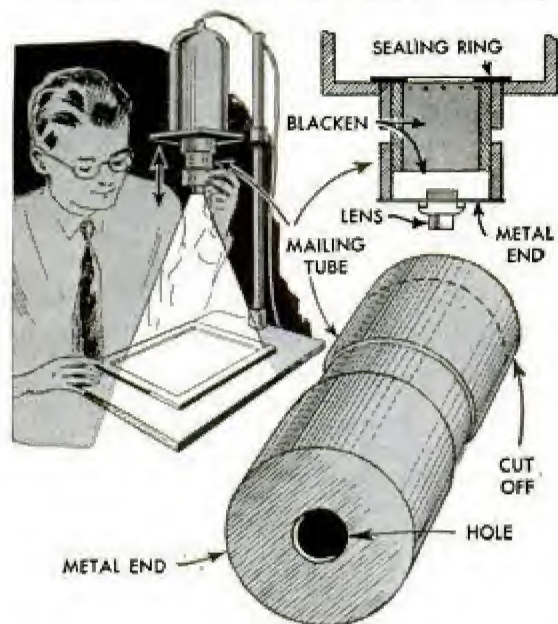
Movies Projected on the Ceiling Entertain Bedridden People



One home-movie fan provides enjoyment for bedridden people by projecting his 16 mm. travel movies on the ceiling above their beds. To do this, he places a mirror at a 45° angle on a stand in front of the projector. The film is reversed in the projector so that the mirror will reflect the image "right side to" on the ceiling.

Mailing Tube Used as Bellows On Homemade Enlarger

An inexpensive and efficient bellows for a small homemade enlarger can be made from a mailing tube of the telescoping type which is fitted with metal ends. The lens



is mounted in one of the metal ends, the opposite end being cut off to the proper length and secured to the bottom of the light housing. The parts of these tubes usually fit together quite snugly, making it possible to adjust the focus critically and causing it to "stay put." Paint the inside of the mailing tube with flat black paint.

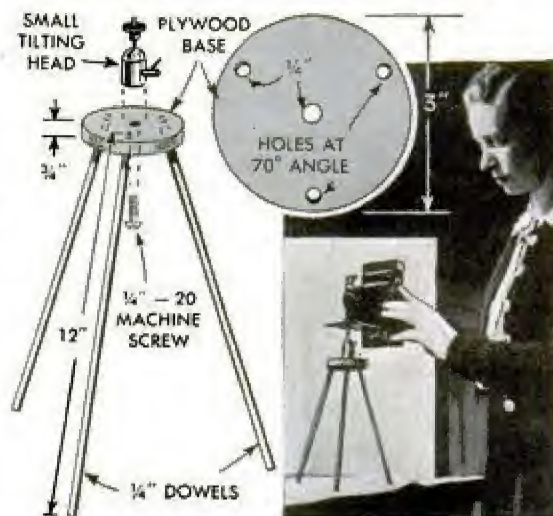
Easy Way to Tighten Ball Clamp On Photographic Reflector

After much use, the ball clamp on a photographic reflector often becomes so worn that it will no longer hold securely even when tightened with the screw provided for this adjustment.



To repair the clamp, take it apart and lightly countersink the inner edges of the openings that clamp against the ball, using a rosehead countersink as shown. When reassembled the clamp will again hold securely due to the sharp beveled edge.

Midget Tripod for Table Tops Is Assembled From Wood



Made entirely of wood, this midget tripod is handy for taking table-top photos with a small camera. The circular top is made of plywood, to which the 1/4-in. dowel legs are glued. A machine screw through the center hole holds the tilting head in place.—M. B. Birge, Rochester, Minn.

☐ White vinegar may be used as a substitute for acetic acid in a shortstop bath; use 1 part of average-strength vinegar to 2 parts of water.



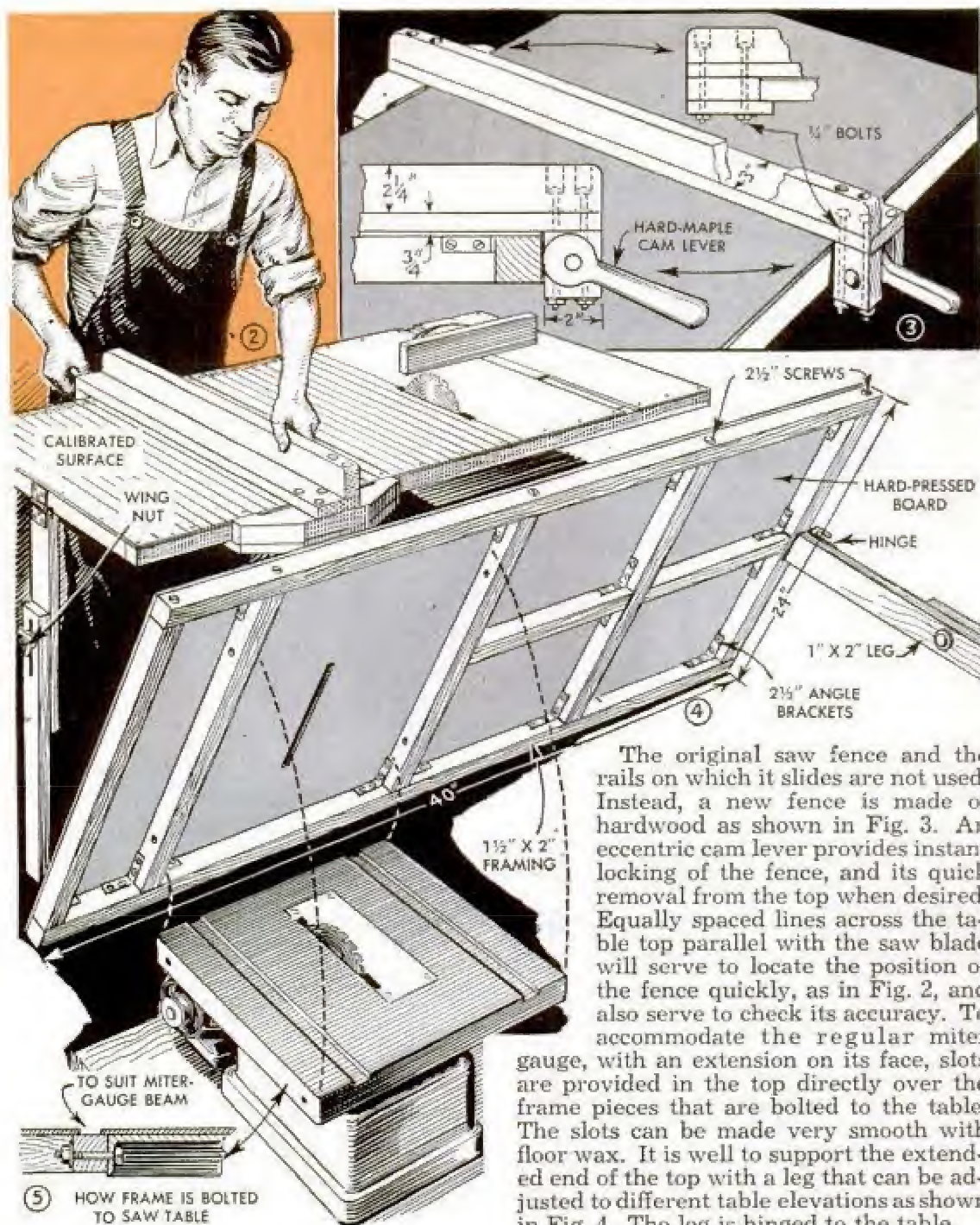
SHOP NOTES

Auxiliary **SAW TABLE** *increases capacity*



OWNERS of home workshops find that the tables of their circular saws often are too small to handle many jobs satisfactorily, especially when cutting large panels. Even the extensions provided by the saw manufacturers do not greatly increase the capacity of the saws. If you have experienced this trouble, the auxiliary table shown above will solve your problem. The dimensions are tentative as they vary with different saw tables. The basic principle for all types of tables is to build the framework of solid hardwood rails,

spacing the second and third rails to fit snugly against the edges of the original saw table to which they are bolted as indicated in Fig. 5. The position of the table on the saw is shown in Fig. 1, while an underside view showing the assembly of the frame and top is given in Fig. 4. The frame can be made any size desired, although the 24 by 40-in. size will handle most jobs encountered in the average home workshop. Tempered hard-pressed board is best for the top as it is slick when waxed, enabling work to be pushed over it easily.



The original saw fence and the rails on which it slides are not used. Instead, a new fence is made of hardwood as shown in Fig. 3. An eccentric cam lever provides instant locking of the fence, and its quick removal from the top when desired. Equally spaced lines across the table top parallel with the saw blade will serve to locate the position of the fence quickly, as in Fig. 2, and also serve to check its accuracy. To accommodate the regular miter gauge, with an extension on its face, slots are provided in the top directly over the frame pieces that are bolted to the table. The slots can be made very smooth with floor wax. It is well to support the extended end of the top with a leg that can be adjusted to different table elevations as shown in Fig. 4. The leg is hinged to the table.

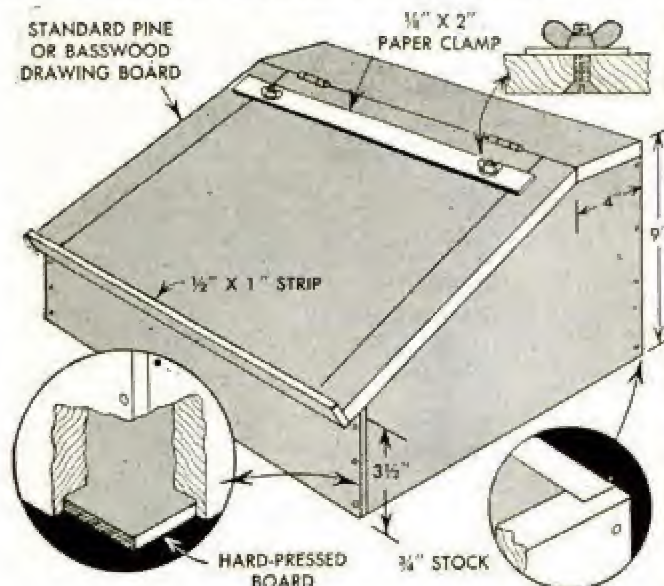
Oilcloth Protects Door From Mechanic's Greasy Clothes

Mechanics and others who drive their cars when wearing greasy clothes know that seat covers are only a partial solution to protecting the upholstery, as the driver's knees still come in contact with upholstery on doors. To protect these areas, several oilfield workers have placed bright-colored oilcloth over the upholstered doors immediately after purchasing a new car.

Such covers are cut to exact size from paper patterns, which are first measured and marked with positions for door-latch handles, window cranks, etc. In addition to being easy to clean, these covers also give the car an added touch of color, especially if the material is chosen with an eye toward matching the seat covers.

—Raymond F. Waters, Hobbs, N. Mex.

Portable Drawing Box Is Handy in the Shop



Portability, convenient storage space, a comfortable working angle, a shelf to set pencils, ink and other instruments within handy reach, and a clamp to hold paper, which eliminates the need of thumbtacks, are some of the advantages of this combination drawing board and cabinet. It consists of a standard drawing board hinged as shown to the shelf of the cabinet, which is made of $\frac{3}{4}$ -in. stock. The bottom edges

of the sides are rabbeted to take a panel of hard-pressed board, and a $\frac{1}{2}$ -in. ledge is screwed to the lower edge of the drawing board. Two machine screws fitted with wing nuts hold a metal or hardwood paper clamp. If desired, a handle can be attached to the narrow side to facilitate carrying, in which case a hook and eye should be provided to keep the top closed.

—H. F. Whittaker, Toronto, Can.

Pistol-Type Handle for Hacksaw Where Space Is Limited

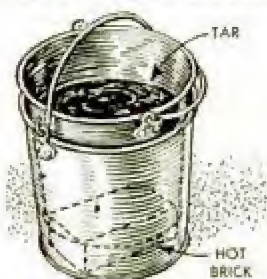
Where space is not available to use a regular hacksaw frame, this pistol-type handle will be just the thing. It is jigsawed



from a piece of hardwood, grooved on one side to take the blade and is fitted with a metal plate as indicated. Although the plate helps to hold the blade, the latter is locked in place by a small wood screw driven into the handle. If the teeth on one end become dull, a new cutting edge can be provided quickly by turning the blade end for end, although in this case the teeth will point toward the handle.

Roofing Tar Warmed With Brick

When patching a roof on cold days where the melted tar may cool and thicken quickly, one repairman puts a heated brick in an extra pail and sets the pail of tar inside it like a double-boiler cooking utensil. The handle of the extra pail is pulled up over the two so that they may be carried as one container.



Step to Enter Rear End of Truck Made From Horseshoe



To simplify the task of climbing into the back of his truck, one farmer bolted a horseshoe to the top of the endgate as shown. When the endgate is folded down, the horseshoe provides a handy step for climbing into the truck body.

Portable Hog Trough on Wheels Is Self-Leveling

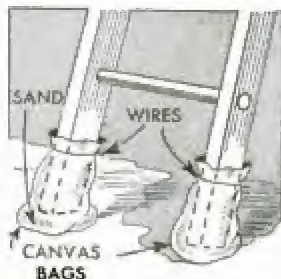
Where hog-feeding grounds are changed often, the task of moving heavy troughs can be eased considerably by fitting each



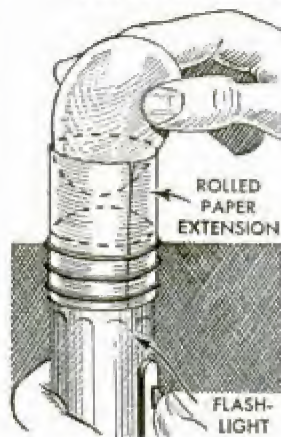
one with a pair of wheels, attached by mounting them on an axle pivoted in the center of the trough end. In this position, the wheels tilt automatically and tend to keep the trough level on rolling ground. To compensate for additional height, the opposite end of the trough is raised by nailing on two stakes.

Sand-Filled "Boots" on Ladder Keep It From Slipping

Instead of dragging around a large bag of sand upon which to rest the legs of his ladder to prevent slipping on wet or icy walks, one painter uses small bags of heavy canvas. These are partly filled with sand and are attached to the legs of the ladder by pieces of wire.



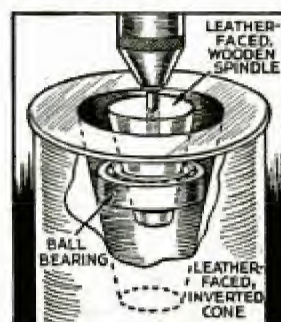
Tube Extension on Flashlight Permits Candling of Eggs



An emergency light for testing eggs in an incubator or for candling them for sale, can be made by wrapping a strip of paper around the end of a flashlight. This should extend an inch or more above the lens. A strip of tape or a rubber band will hold the tube in place.

Ball Bearings Cleaned Quickly With This Simple Jig

In order to clean ball bearing assemblies quickly and easily, one garage mechanic uses this washing device. It consists of a cylindrical container for the cleaning fluid, in which is fitted a conical piece of light sheet metal having the inner surface covered with felt or leather riveted in place. This forms a support for almost any



size of bearing race, the larger ones lying near the top while smaller sizes stop farther down. The facing prevents the outer race from turning when the driving spindle is applied to the inner race. This spindle is a turned wood cone, likewise faced with cloth or leather, and has a $\frac{3}{8}$ -in. steel pin screwed into the large end so the assembly can be used in the chuck of the drill press or breast drill. In use, the bearing to be cleaned is dropped into the inverted cone of the container so that it is covered with cleaning fluid, and the driving spindle is held against the inner race. The outer race is held immovable while the inner one is rotated rapidly by the spindle.

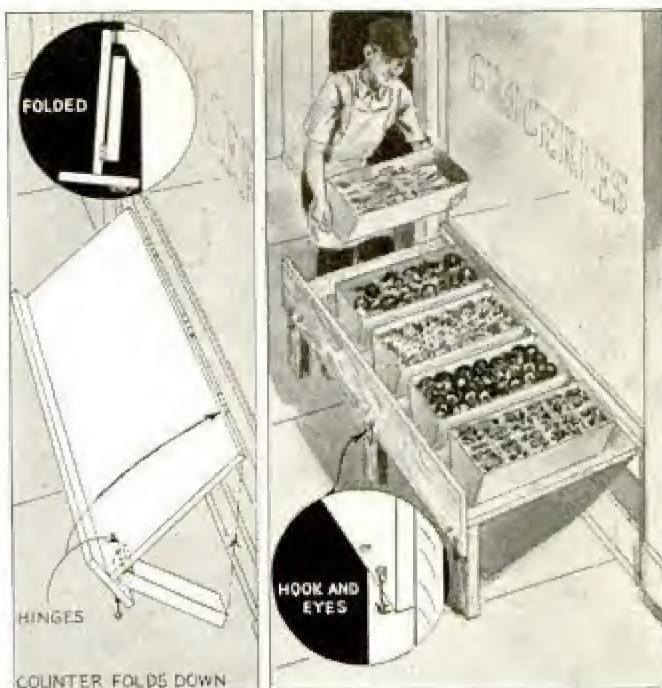
—W. C. Wilhite, Carlinville, Ill.

Rope Slide Raises Hopper For Cleaning Hen House

To hold swinging feed hoppers out of the way when cleaning the floors of his poultry house, or when scattering new litter, one poultryman has them suspended from hooks in the ceiling by adjustable tent-rope slides. These permit the hoppers to be raised or lowered to any position desired in an instant. The adjustable slides can be made easily by drilling a hole for the rope in each end of a length of broomstick or dowel.



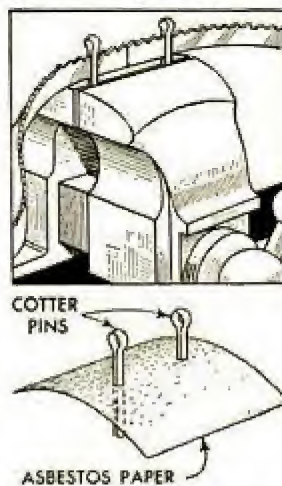
Counter Hinged to Front of Store Folds Out of Way at Night



Displaying a merchant's wares, this outdoor counter is hinged to a window sill which enables it to be swung down flat against the store front when not in use. The counter may be made in one piece if it is not too long, or it can be made in separate sections. Wooden legs provide sturdy support, hooks and screweyes keeping the legs in a vertical position. The legs are hinged to the underside so that they can be folded when the counter is let down.—Opie Read, Jr., Chicago.

Cotter Pins Hold Bandsaw Blade In Vise While Brazing Ends

Instead of making up a special jig to hold the ends of broken bandsaw blades in perfect alignment while brazing, just slip a couple of large cotter pins over the blade and clamp them in a vise as shown. To protect vise jaws against excessive heat from the torch, a piece of asbestos paper can be held in place under the blade by forcing both cotter pins through the center of the paper before clamping them in the vise.





Super-GAGES and

By H. J. Chamberland

be air-conditioned, with the temperature constantly held at 68 degrees Fahr. The steel blanks from which the blocks are to be made, are cut in predetermined sizes and quantities. Then they are finish-ground on four edges but only rough-ground on the two opposite faces between which the distance is to be the measuring dimension. Next, the blanks are heat-treated and seasoned to stabilize the steel so that any change in temperature will not affect their accuracy when used at the 68-degree temperature, at which they are finished. Seasoning or "aging" of steel, which used to be a six-month process, is now done artificially in a few hours by repeatedly freezing and heating the parts. The freezing-and-heating cycles alternate

GAGE BLOCKS, made of high-quality steel, are either square or rectangular in shape and of varying thicknesses. They are artificially seasoned or "aged," and are ground and lapped to such a high degree of surface smoothness and parallelism that a number of the finished blocks can be wrung together to hold fast as shown in Fig. 4.

Relation of gage blocks and gages: Although they are the basis of standardization of measurements and hence the key to interchangeability of parts, gage blocks themselves are not used to measure parts being machined in quantities but are used only for checking the accuracy of gages that are used for this purpose. Gages are checked with gage blocks not only at the time that they are made, but also during their period of use because they are subject to constant wear, for which frequent corrections must be made. The use of gages for making accurate measurements is more reliable, more convenient and faster than the use of micrometers.

How gage blocks are made: If you are working in a machine shop or intend to do so, you are using or will use some type of gage. Therefore, a brief description of how gage blocks are made will prove profitable. Rooms in which gage blocks are made must



- (3)
- A—Set of 81 gage blocks consisting of**
- 9 blocks from 0.1001 to 0.1009 inclusive, increasing by ten-thousandths in. (0.0001)
 - 49 blocks from 0.1010 to 0.149 inclusive, increasing by thousandths in. (0.001)
 - 19 blocks from 0.050 to 0.950 inclusive, increasing by fifty-thousandths in. (0.050)
 - 4 blocks from 1 to 4 in., increasing by 1 in.
- B—Gage-block combination for dimension 1.4373**
- | |
|-----------------------------|
| 1.4373 dimension wanted |
| —0.1003 from 9-block group |
| 1.3370 |
| —0.1370 from 49-block group |
| 1.2000 |
| —0.2000 from 19-block group |
| 1.0000 |
| —1.0000 from 4-block group |
| 0.0000 |

Precision with GAGE BLOCKS

Accurate to within few millionths of an inch from specified sizes, gage blocks are the super-precision measuring tools of industry, making possible today's multiple mass production of mutually fitting and interchangeable parts which are fabricated in many widely scattered shops for later assembly

with several light grinding operations, the blank being dressed down gradually to within .001 in. of the finish size.

Lapping of the blocks is done on a machine as shown in Fig. 1, the blocks being held in rings that rest on the revolving table. The top circular member, or lapping plate of the machine is charged with the finest lapping compound available, and is gently lowered to barely contact the revolving blocks momentarily. The blocks are reversed and transposed frequently between very short lapping contacts, and the actual time required to remove metal of a few millionths of an inch is only a matter of seconds.

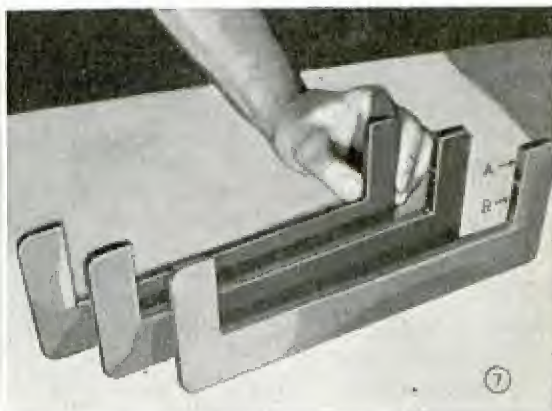
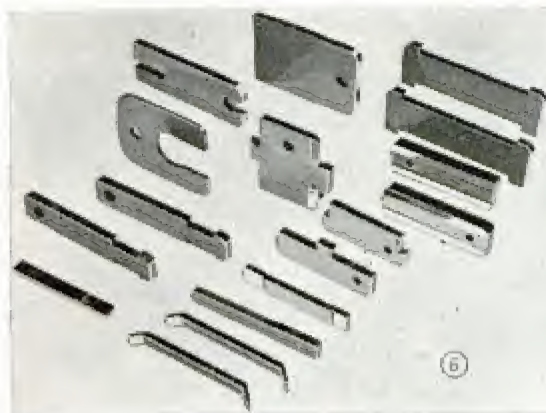
The working surfaces of gage blocks must be precisely flat and parallel. This is checked with an instrument that shows the amount of flatness error by means of light waves. With this instrument use is made of a monochromatic light such as Neon, and a quartz disk, the surface of which is finished to within two-millionths of an inch. The pattern of the shadows denotes the amount of error in the flatness and parallelism. With another instrument, shown in Fig. 5, an operator obtains the finish size from a set tested and approved by the U. S. Bureau of Standards.

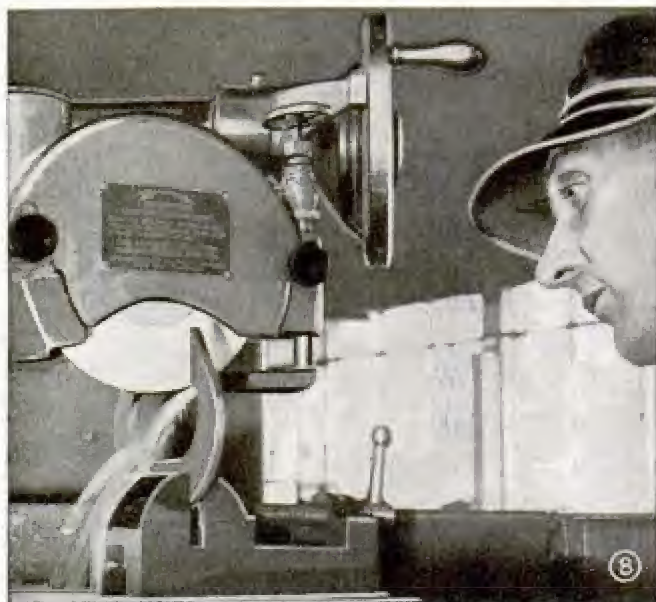
Using gage blocks: Gage blocks, a group of which are shown in Fig. 2, are made in sets varying in quantity to suit individual



needs. A set commonly used consists of eighty-one blocks as described in detail A of Fig. 3. With the use of such a set it is possible to arrange a combination for any dimension from 0.1 in. to over 10 in., in steps of .001 in., and any dimension from 0.2 in. to over 10 in., in steps of .0001 in.

When combining blocks to arrive at any predetermined measurement, it is highly

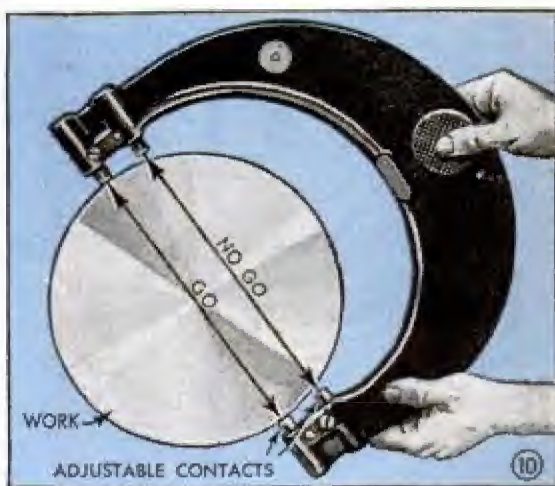




important to use as few of the blocks as possible, and to clean off all rust-proofing, dust, grease or other foreign matter before they are wrung together to produce the equivalent of a single block. Wringing is done by placing two blocks together and twisting them to obtain good contact. Then one block is slid partially off the other and is returned to a position of full engagement while pressing both blocks together. To take them apart again, the sliding motion is repeated. When selecting blocks to combine for a dimension which, for example, is 1.4373 in., as shown in detail B of Fig. 3, you begin by using a block having the last right-hand figure, which in this case is 3. The proper block, found in the group of 9 blocks increasing by .0001 in., is 0.1003. Subtracting this from 1.4373, you have a remainder of 1.3370. The next two right-

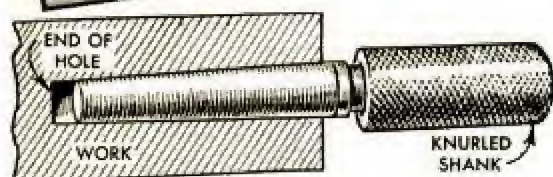
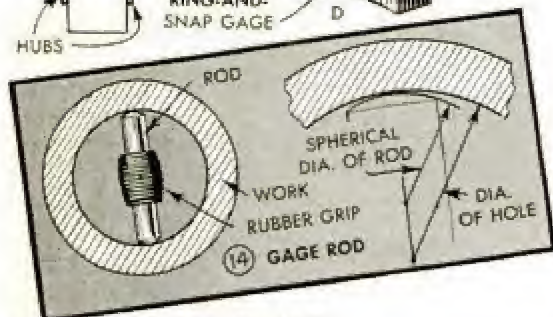
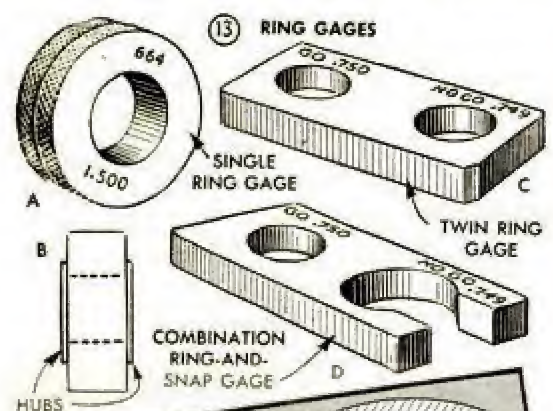
hand figures can be eliminated by using the 0.1370-in. block from the 49-block group. Subtracting 0.1370 from the previous remainder, you get 1.2000 in. as the remaining measurement still to be "filled," which you can do by using the 0.200-in. block from the 19-block group, and the 1-in. block from the 4-block group, which reduces the total to zero. To prove the correctness of using these blocks just add them together to obtain a total of 1.4373. The reason that as few gage blocks as possible should be used in any combination is that each gage block may have an allowable error of two to eight millionths of an inch, and the use of an unnecessary number of blocks may increase the amount of total error.

Types of gages: There are many types of gages, each of which varies in design. Snap, plug, and ring gages are in common use. A typical assortment of snap gages is shown in Fig. 6. They are used to measure recesses, projections, distances between shoulders, multiple depths, widths, etc. Most snap gages have a "go" and a "no go" section; "go" designating the correct dimension and the "no go" indicating that if the part being measured penetrates, the part is undersize. Three shop-made snap gages are shown in Fig. 7; A and B are the "go" and "no go" sections respectively. Fig. 8 shows a snap gage of different design, being ground .001 in. undersize on a tool-room surface grinder. Fig. 9 shows a frequent application of gage blocks, namely, to check snap gages while they are being made.

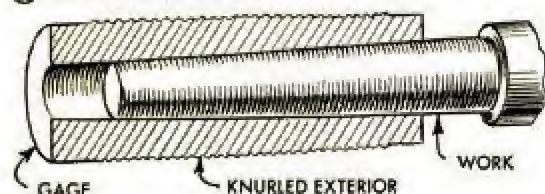


In Fig. 11 four identical snap gages are being lapped simultaneously. Spacing the gages as shown provides essential support for the cast-iron lap. All gages are lapped to remove high spots that would soon be reduced by initial wear. The snap gages already referred to are not adjustable. However, the one shown in Fig. 10 has contact points that can be adjusted to compensate for wear. Snap gages are often machined in multiples to reduce cost; the procedure is to clamp the blanks together, then drill, ream and mill the openings. After hardening them, plugs are used to realign them for grinding and lapping in gangs. However, the final lapping is done individually on each one.

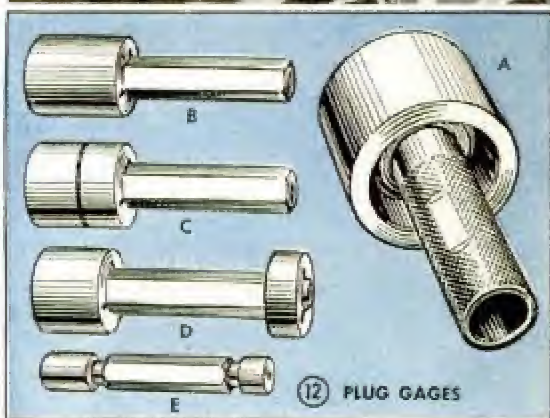
To measure internal and external cylindrical surfaces, plug and ring gages are used. Plug gages, five styles of which are shown in Fig. 12, are used to measure holes. Gage A is known as a single-end



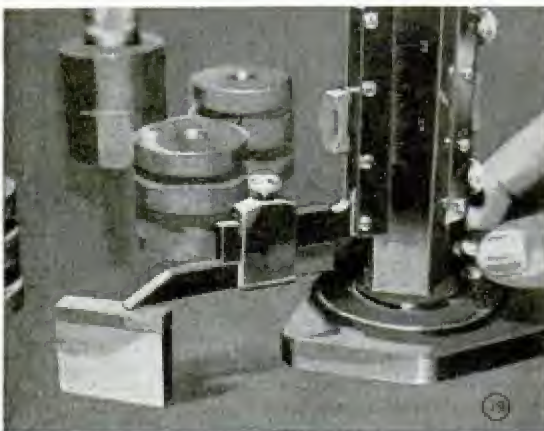
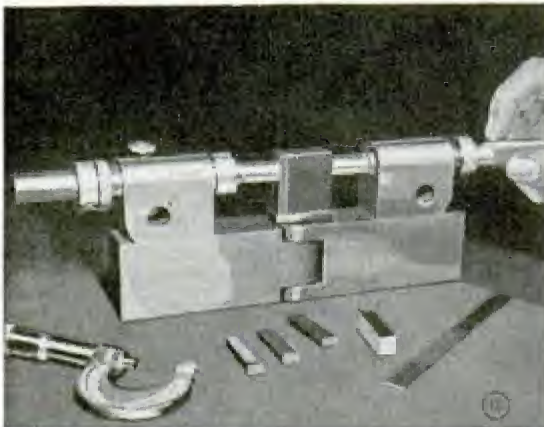
15 INTERNAL TAPER GAGE



16 EXTERNAL TAPER GAGE

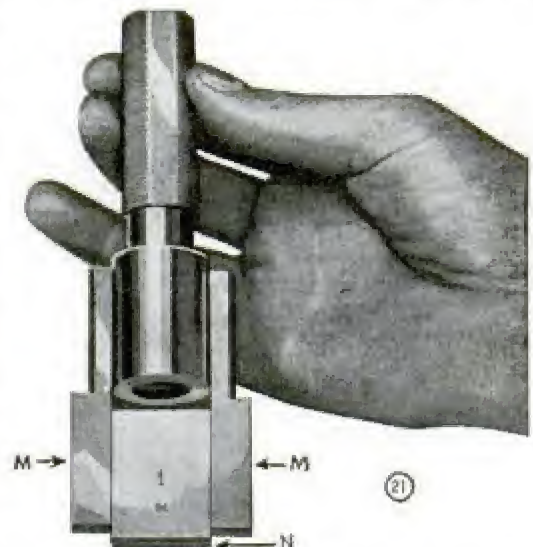


plug gage; these are made in large diameters, are counterbored at each end to reduce weight, are fitted to a threaded holder and are reversible. When the size of the hole is reached, the plug penetrates freely without much friction on 80 to 90 percent of the periphery. B is a smaller standard single-end plug gage. It is fitted to a hexagon-shaped handle or shank held with a screw, and is also reversible. C is a "progressive" or "tolerance" plug gage, the section beyond the undercut being oversize according to the tolerance permitted. The tool is not reversible. D is a standard double-end plug, the wider end is "go" and the narrow end is "no go." The plugs are of different widths so that the user can differentiate between the two at a glance to avoid using the "no go" end first. This plug is reversible. E is a smaller double-end plug, called the "taperlock" style because the sizing members have tapered shanks fitting the handle. This style of plug is not reversible.



Detail A of Fig. 13 shows a ring gage. These are made with holes ranging from $\frac{1}{16}$ to 4 in., and are usually made with hubs as shown in detail B so that the edges of the holes will not be "bellmouthed" when the gages are ground and lapped. The hubs are ground off as a final step of manufacturing. Details C and D of Fig. 13 show designs of a twin ring gage and a combination ring-and-snap gage respectively. A low-cost internal gage, better known as a gage rod is shown in Fig. 14. It is used mostly for checking large holes. Note that its ends are spherically smaller in diameter than the diameter of the hole it is intended to measure. Figs. 15 and 16 show conventional taper-plug gages. The one in Fig. 15 is used to verify internal tapers, such as sleeves, machine spindles, etc., while the one shown in Fig. 16 is used for external tapers such as measuring shanks on drills, reamers, etc.

Sets of gage blocks needed: The gage-block standardization system consists of three grades of precision sets. First comes the laboratory set costing about \$2,000, which is kept under lock and key and often in a safe or fireproof vault. It is accurate to within plus or minus two-millionths in., is used only periodically to verify another set called the inspection set, which is accurate to within plus or minus four-millionths in. This one is used to check all measuring tools used for inspection and to check a third set of gage blocks known as a working set, which is accurate to within plus or minus eight-millionths in., and is considered tool-room equipment. It is customary to compare the inspection set with the laboratory set once monthly, and the working set with the inspection set every week. Large plants need all three sets but a medium-size plant may get along with an inspection set costing about \$1,000.



It is too risky to use only a working set unless outside means of comparison with a laboratory set are available from time to time.

Methods of checking: Figs. 17 to 21 show how a number of tools are checked in regular routine. Micrometers are checked frequently on a precision disk, Fig. 17, which in turn is checked periodically by comparing it to a gage block of corresponding size. Fig. 18 shows a bench-type snap gage being set with a two-block combination. Another inspection job is shown in Fig. 19, where a vernier height gage is being set with blocks, the height gage being used to measure plug gages shown in the background. In Fig. 21 another method of checking a plug gage is shown. Parts M-M are parallels and are wrung onto gage block N. Fig. 20 shows how working gage blocks are used to check distance between holes in which two plug gages are set.

Laboratory gage blocks are seldom touched with fingers. They are removed and replaced in their case with padded tweezers to avoid finger marks. All gage blocks should be kept in good condition by wiping them with a special cleaning compound after they have been used.

Old Fence Posts Absorb Moisture From Stored Grain



A simple method of avoiding undue sweating and spoilage of stored grain that has an excessive moisture content is to place old cedar fence posts on end in the bin at the time of storing. Only untreated posts should be used, and these should be equally spaced in the bin about $2\frac{1}{2}$ to 3 ft. apart each way. Where the depth of the grain is greater than the length of the posts, others are placed above the first tier of posts as the bin is filled.

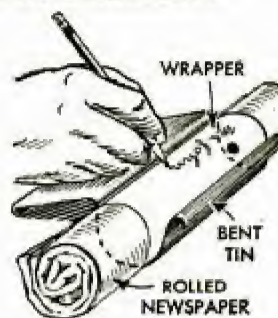
Dividing Board in Sidewalk Form Held Without Nailing



For pouring a concrete sidewalk, one home owner assembled a dividing or end board for the forms, which could be held in place without stakes or nails. This was done easily by providing the board with a simple spring arrangement consisting of two sections cut from a wooden barrel stave and nailed to one side of the board as shown, letting the ends project about 1 in. When bent, the stave sections fit snugly between the sides of the form and support the divider in any position desired.

Rolled Newspapers Addressed In Sheet-Metal Handrest

In newspaper offices, where many copies of papers are wrapped ready for mailing before being addressed by hand, this little device will prove a time and labor saver. It consists of a piece of sheet metal, bent as shown, to hold the wrapped paper securely so that the portion to be addressed will be flush with a flat part of the holder, which serves as a handrest when writing.



When using a surface grinder and you wish to remove only a thousandth or a half-thousandth of an inch, place a piece of cigarette paper on the work and bring the wheel down gradually until it throws the paper off. Then, you are ready to make the cut accurately.

Pivoted Rod in the Shop Dustpan Catches Small Parts



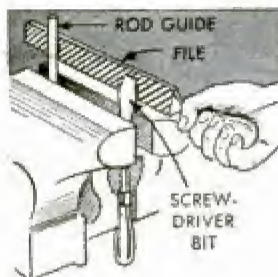
By pivoting a short length of rod in your shop dustpan, screws and other small parts that are swept up will be retained in the pan when shaking out dust and other foreign matter. Bent to a wide U-shape, each end of the rod is inserted into a hole drilled on each side of the dustpan near the lower edge.

Probes Made From Heavy Wire

Needing a number of sharp probes for laboratory work, one workman made them from lengths of heavy steel wire, which was cut into pieces to be twisted and sharpened as indicated. Wrapping the wire around itself provides a convenient hand or finger grip for easy use of the probes, and eliminates the difficulty of obtaining wood handles and fitting the probes into them.



Shaping Screwdriver Bits True



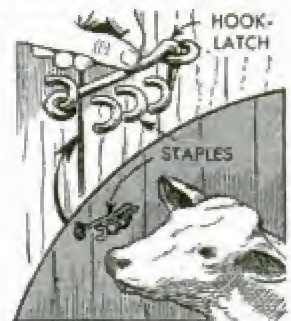
A screwdriver blade that is off true even a little is not only an aggravation, but is likely to ruin the screw slot besides marring the surface alongside the screw head. To

assure absolutely flat and parallel planes on both sides of the bit when shaping it with a file, fasten it with the working end up in a vise so that its long axis is lined up with the vise opening. In the other end of the vise grip a heavy nail or light bolt of the same thickness as the bit. Rest the forward end of your file lightly against this bolt as a guide while working, and you will produce a perfectly shaped bit.

—L. Schneider, Clinton, Mo.

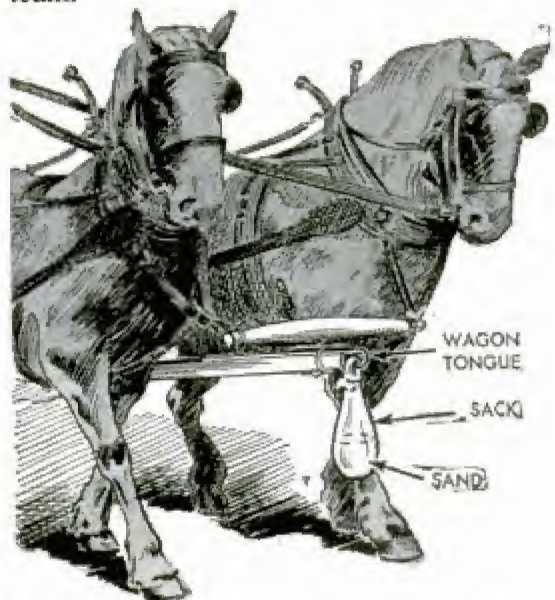
Staples Driven Under Door Latch Prevent Animals Opening It

To keep calves and other animals from nosing open the hook latch of his granary door, one farmer drove several staples below it as indicated. The staples took care of the problem nicely and did not interfere with opening the latch with one's fingers in the regular way.

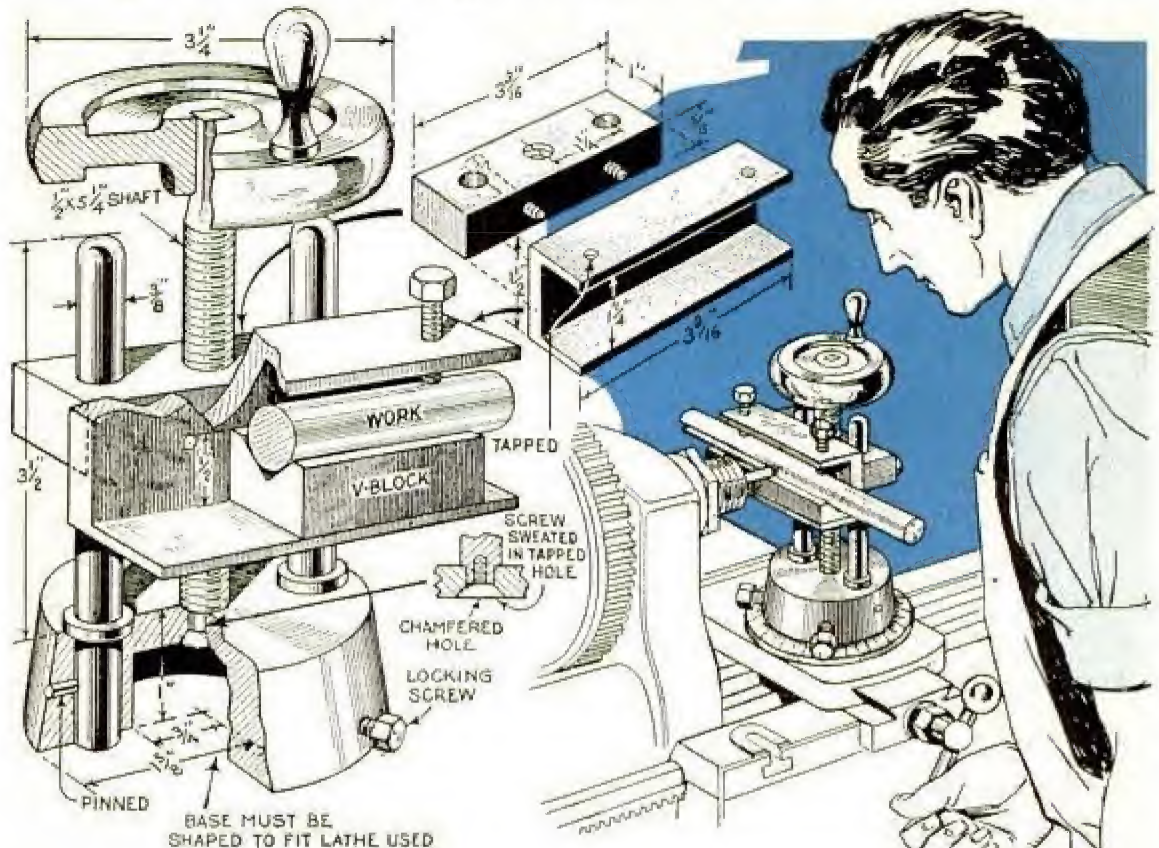


Sandbag on Implement Tongue Prevents Tangling of Lines

Having a team of horses that frequently lowered their heads and permitted the driving lines to be caught under the end of an implement tongue, one farmer prevented this trouble by hanging a small sandbag on the tongue. The bag added very little weight on the necks of the horses and did not interfere when the tongue was lowered to the ground after unhitching the team.



Inexpensive Milling Attachment for Your Lathe



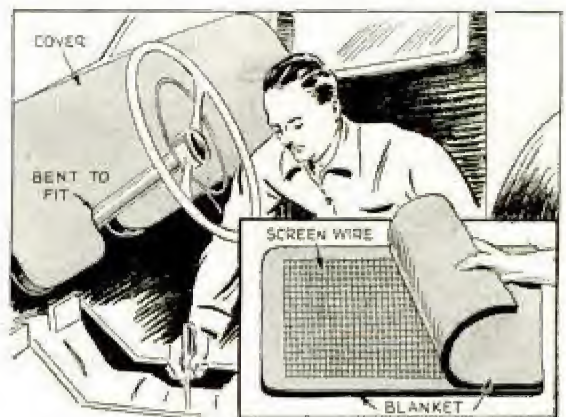
With this attachment on the tool post of your metal-turning lathe you can do many types of light milling jobs, such as cutting keyways, spline slots, etc. Almost any shop scrap box will yield sufficient material for making the attachment, which is fitted to the lathe carriage in place of the compound rest. Although the attachment shown was made to fit a particular type of lathe, it can be adapted to other types by shaping the base to suit. To avoid looseness, which might cause the milling cutter

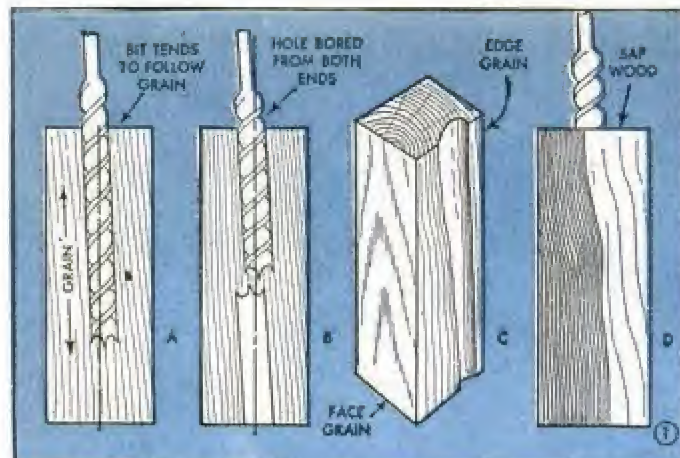
to chatter against the work, all parts must be fitted accurately. This is especially true of the vertical guides or ways on which the work holder slides. They must fit tightly into the base in which they are pinned, and they must be a snug, sliding fit through the holes in the work holder. Also, it is important that the threaded shaft be a good fit in the tapped hole of the holder.

Cover Protects Instrument Panel When Working in Car

After accidentally breaking the glass faces of some of the instruments on the instrument panel of a car, one mechanic made a cover to protect the instruments on future jobs. It consisted of two pieces of heavy blanket cloth sewed together with screen wire between them. The wire adds stiffness to the cover so that it will hold any shape into which it must be bent to fit over various instrument panels. When made in the correct shapes, covers of this type also are handy for protecting other parts of a car, such as windows and headlights, from accidental damage.

—Opie Read, Jr., Chicago.



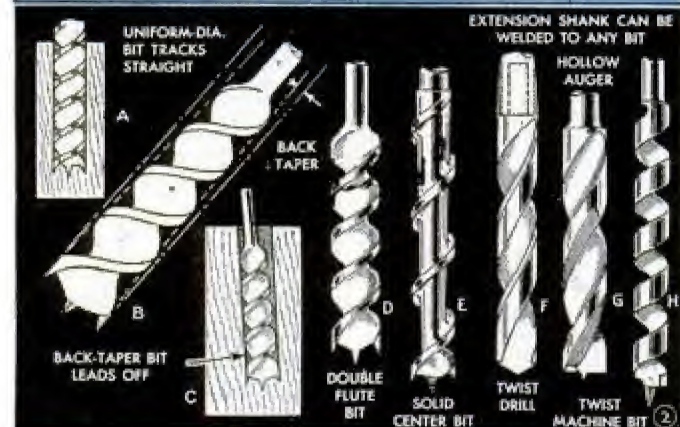


THE WOOD

When boring into end grain, the natural tendency of any bit is to follow the grain, as shown at A. B shows that boring from both ends puts the grain-leading error in the worst position—at the center of work. The tendency of the bit is to follow the edge grain, C, or, in other words, the bit will have a tendency to drift toward the sides which show face grain. Obviously, sapwood, being softer than heartwood, will cause the bit to drift, as shown at D. Best results are obtained in clear wood with straight grain, but any wood can be bored true with reasonable care.

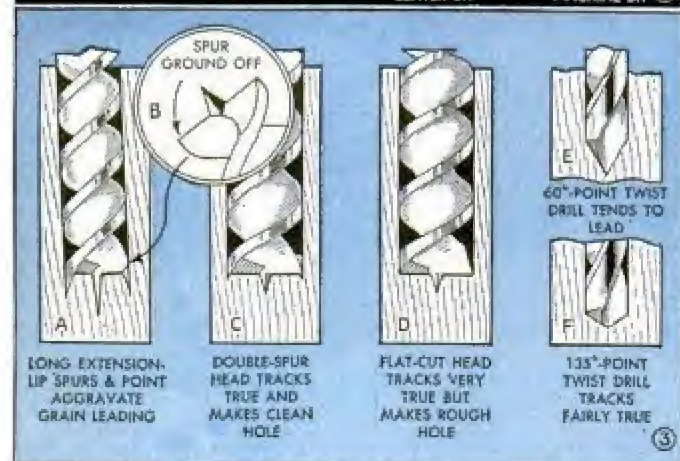
THE BIT BODY

For best tracking, the bit body should be of uniform diameter as shown at A. Bits having excessive back taper, B, have a decided tendency to lead with the grain, C, when used in a fixed machine setup. Various styles of bit bodies are shown in D to H. Double-flute and solid-center bits commonly have excessive back taper. Twist drills, twist machine bits and hollow augers have practically uniform diameter throughout and track well if started straight. The hollow auger, H, is best for deep holes as it carries out chips through its hollow center.



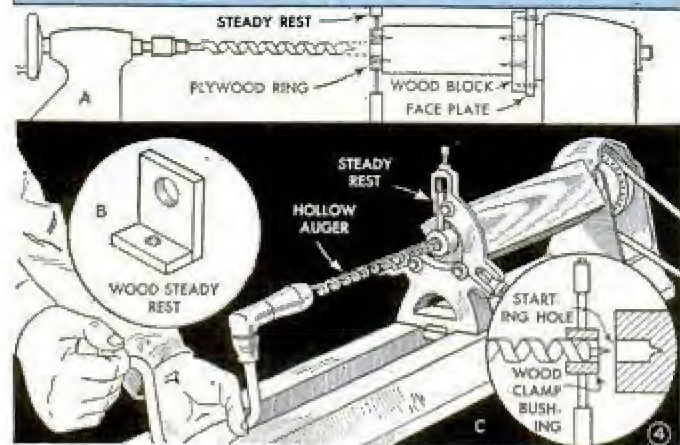
THE BIT HEAD

The popular extension lip spur bit, A, is not a good bit for deep holes because the long spurs act as rudders causing grain leading. Better results can be obtained with this bit by shortening the length of the spurs or grinding them off entirely, B, after which the bit tracks nicely but bores a rough hole. The double spur head, C, is a good general type, equally suitable for end or cross-grain boring. The flat head, D, is the best tracker in end grain, but bores a rough hole. An ordinary twist drill tracks much better with a blunt point, F, than with a sharp point, E.



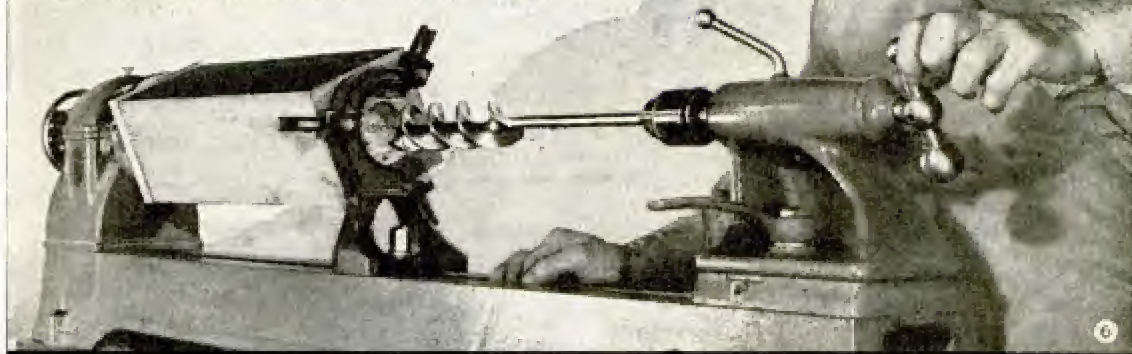
WORKING METHODS

Best method of drilling a deep hole is to chuck the work in the lathe and rotate it at slow speed while advancing the bit from the tailstock, as shown at A. B pictures a wooden steady rest which can be used if a regular one is not available. An excellent method of freehand boring, useful when the combined length of work and bit prohibits use of the tailstock, is shown at C. This requires a starting hole in the work, bored with a short bit of the same diameter. A bit of uniform diameter is needed since the bit itself supports the free end of the work.





THE TWO COMMON METHODS OF DRILLING ON THE LATHE:
ABOVE—DRILLING FROM HEADSTOCK WITH WORK STATIONARY
BELOW—DRILLING FROM TAILSTOCK WITH WORK REVOLVING



Boring DEEP HOLES in Wood

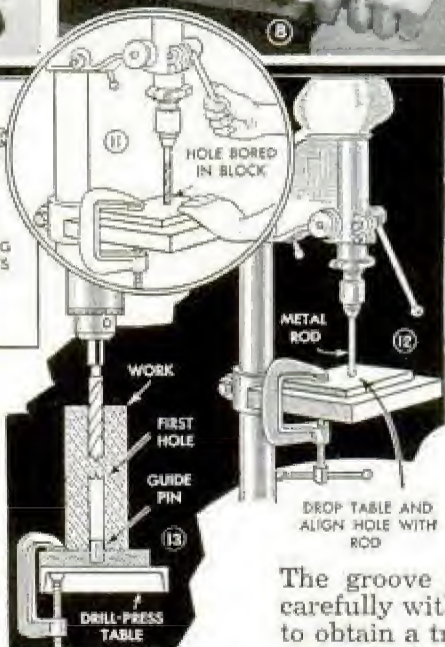
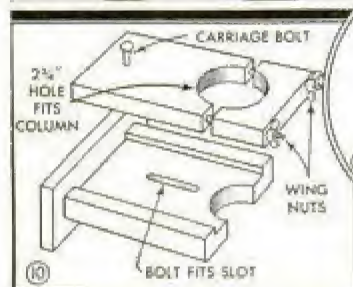
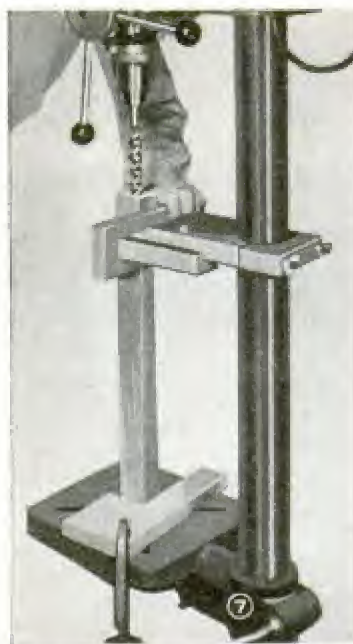
DEEP HOLES are those running from 20 to 60 diameters in depth. These extreme depths are easily and accurately cut in any kind of wood provided the proper type of bit is used and reasonable care is exercised in making the machine setup. Straight tracking is of prime importance. It is obvious that a bit will tend to follow the grain of the wood, as explained in Fig. 1 on opposite page. Figs. 2 and 3 picture and explain the features of wood-boring bits which aggravate or correct the natural tendency of grain leading.

From a study of the drawings and text on the opposite page, it will be apparent that one of the important features of the bit is uniform diameter throughout its length. Some types of wood bits have excessive back taper (as much as $\frac{1}{8}$ in. in an 8-in. twist), and this type of bit invariably drifts with the grain until one of its edges is solidly supported by the wood, as shown in Fig. 2-C. A bit with excessive back taper never should be used in a fixed machine setup, such as drilling from the lathe tailstock, as shown in Fig. 4-A and in Fig. 6. A bit with excessive back taper can be used successfully in any machine setup where the work is not in a fixed position, such as drilling from the lathe headstock, as shown in Fig. 5. If proper attention is given to frequently checking the accuracy

of a hole by releasing the tailstock, the work can be set over one way or the other to correct any grain-leading tendency.

Boring from the lathe tailstock is undoubtedly the most accurate method since the revolving work tends to follow the axis of the bit. Further assurance of correct tracking is obtained by selecting a bit with short spurs or spurs entirely behind the cutting lips. Extension spurs on a wood bit are required only for cross-grain boring where an outlining cutter is essential to sever cross-grain fibers in the wood. When boring end grain, however, (and most deep holes are bored in end grain) the extension spur is unnecessary and actually becomes a detriment since it burns easily, becomes dull quickly, and unless it is razor sharp it tends to follow rather than cut through the hard ridge grain.

A true start is important. It is sound practice to use a short bit to start the hole since its shorter length and greater stiffness guarantees true tracking. Twist machine bits make ideal starting bits. First choice for a deep-hole bit is the hollow auger. This has a flat head with single cutting lip and is of uniform diameter throughout. The other bit styles shown in Figs. 2 and 3 are excellent provided the back taper is not excessive, and the head is double spur or flat cut. The ordinary twist



drill makes a fairly good deep-hole drill when ground to a very flat point, as shown in Fig. 3-F. The 60-degree point commonly recommended on twist drills for wood boring is positively at fault for deep-hole boring as the sharp point tends to follow the grain rather than cut through it.

While the lathe provides the best setup for deep-hole boring, the drill press is also useful, particularly on work which is drilled from both ends. In making the setup for this, a hole is drilled in a block of wood, Fig. 11. Then the drill table is lowered the required distance and the hole in the block is aligned with the chuck by using a metal rod, as shown in Fig. 12. Next, the work is drilled as deep as possible from one end, after which the first hole is located over a guide pin fitted in the wood block, Fig. 13, to align the work for the second hole. If the ends of the work are true and square with the sides, this method shows good results. Where a deep but not a through hole must be bored in the end

of the work, the holding device shown in Figs. 7 and 10 can be used to advantage. Fig. 8 pictures the conventional method of blocking up the work after drilling to the full length of the drill-press feed (usually about 1 in.). Blocking up in this manner is simpler than raising the table and also provides a base block when the bit breaks through. Fig. 9 illustrates the use of a wooden V-block in drilling from both ends of cylindrical work. The groove of the vee must be aligned carefully with the axis of the drill in order to obtain a true hole.

The groove of the vee must be aligned carefully with the axis of the drill in order to obtain a true hole.

In all deep-hole drilling a slow feed should be used. Give the bit time to cut. It is always good practice to withdraw the bit entirely at frequent intervals to make certain that the hole is not clogged with chips. On important work, such as drilling a gun stock, frequent checking with a dowel stick inserted in the partially drilled hole is a worthwhile precaution.

Preventing Loss of Shop Badges

Machine operators and others who are required to wear an identification badge while at work can guard against the loss of it by simply attaching the badge to a watch or key chain hooked in a buttonhole. With this arrangement, an emergency fastener is provided to hold the badge in case the pin-type clasp becomes unhooked.



Radio

Auto Set Suggestions

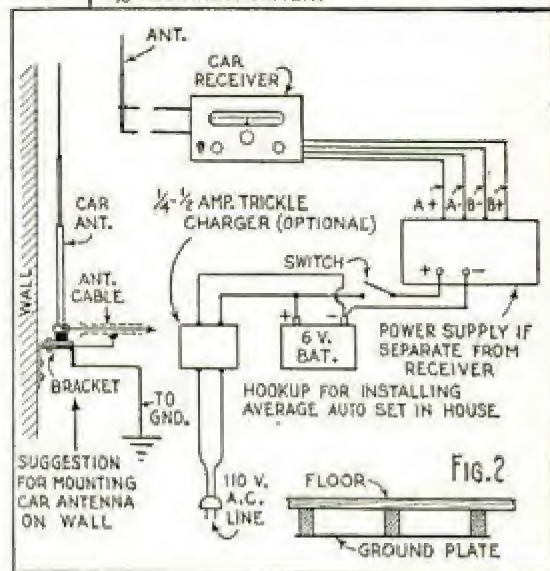
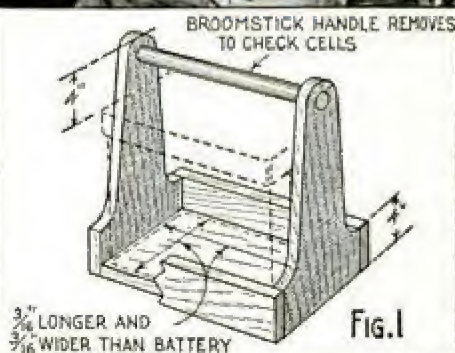
IF YOU have stored your car for the duration, a good radio receiver probably is idle. These auto sets can be moved indoors and used to "pinch hit" for home receivers that are temporarily out of order. They are also ideal for use on boats as they can be mounted in a locker, with flexible cable controls brought out to a convenient operating panel.

A simple boy's room installation of a compact auto set having a separate speaker is illustrated in the sketch. The set, originally designed for mounting under the instrument board of the car, is screwed to the underside of a small table and the speaker is placed above. The rod antenna is mounted on the wall by means of a bracket, and the leads are connected to the set in the usual manner. No change in the wiring is necessary, but a suitable ground must be provided to replace the car frame and body connections. As the 6-volt car battery is employed to operate the set, it may be placed under the table, in the handy wooden battery box detailed in Fig. 1. This is made of $\frac{3}{4}$ -in. plywood soaked in paraffin to make it acid resistant.

Fig. 2 shows an indoor hookup diagram which includes connections for a trickle charger if desired. Of course the storage battery should be kept well charged, and it is better to use it than to leave it idle in the car. Connections are indicated for a separate power unit; however in most auto radios this power unit is built into the set, and in that case the 6-volt battery cable will connect directly to the set. If the controls are cabled to a small dash panel, this panel can be removed and mounted at any convenient point on the operating table.

The ground plate will offer the only problem in making the installation. A large sheet of metal under a carpet or rug will answer in an emergency. If the set is installed in a ground floor room, the best solution for the problem is a sheet metal ground plate fastened to the floor joists in the basement as detailed in Fig. 2.

Auto sets give excellent results in motor boats as they are well shielded and filtered thus eliminating the noises usually encountered with the electrical systems.



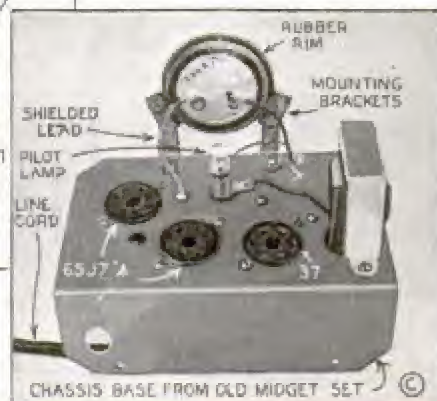
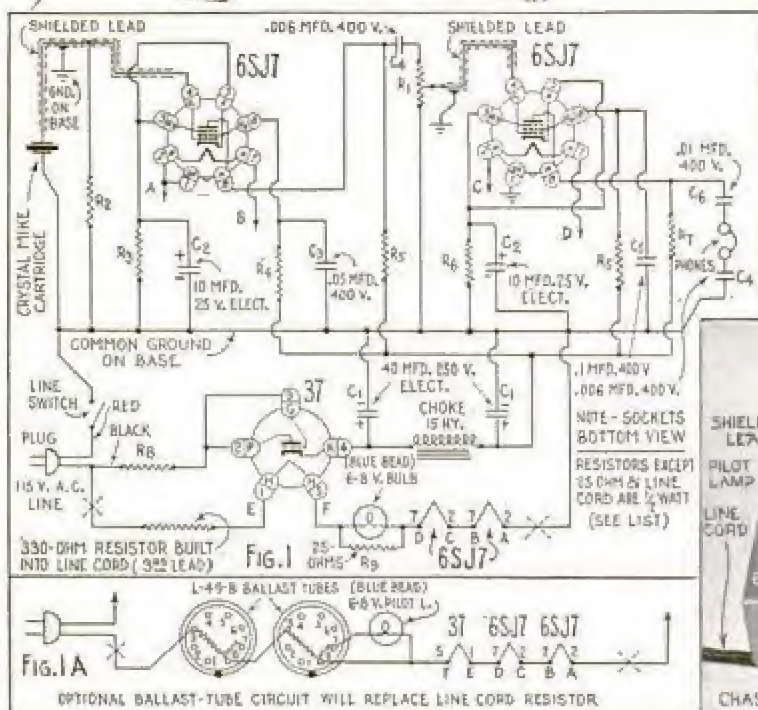
General Purpose PRE-AMPLIFIER



ASSEMBLED from parts most of which were obtained from a discarded midget receiver, this tiny audio amplifier was designed for trying out various types of homemade acoustic systems to aid civilian aircraft spotters. It also provides an excellent pre-amplifier for home recording units that operate through the audio stages of a radio receiver. These often require a pre-amplifier to obtain the necessary boost to make good recordings on some of the small blanks that servicemen like to mail home. It also supplies sufficient pre-amplification for making group recordings of general room conversations for entertainment purposes.

An ordinary type 37 tube is used as a rectifier, and two 6SJ7GT tubes in a very high gain circuit. The schematic diagram appears in Fig. 1, and the simplified wiring diagram and parts specifications in Fig. 2. The volume control may be either a 1 or 2 megohm audio taper type. Hum is practically nil in the headphones at full volume when used as a sensitive hearing aid. A crystal cartridge taken from an inexpensive home recording crystal "mike" was used for the microphone. This was taken apart carefully and the wires unsoldered quickly with as little heat as possible to avoid damaging the crystal unit. When used as a pre-amplifier this mike is mounted on the chassis base by means of small metal brackets and clamps that grip the soft rubber ring around the mike as shown in photos B and C. If you have a pair of crystal headphones you can use one for the mike and the other

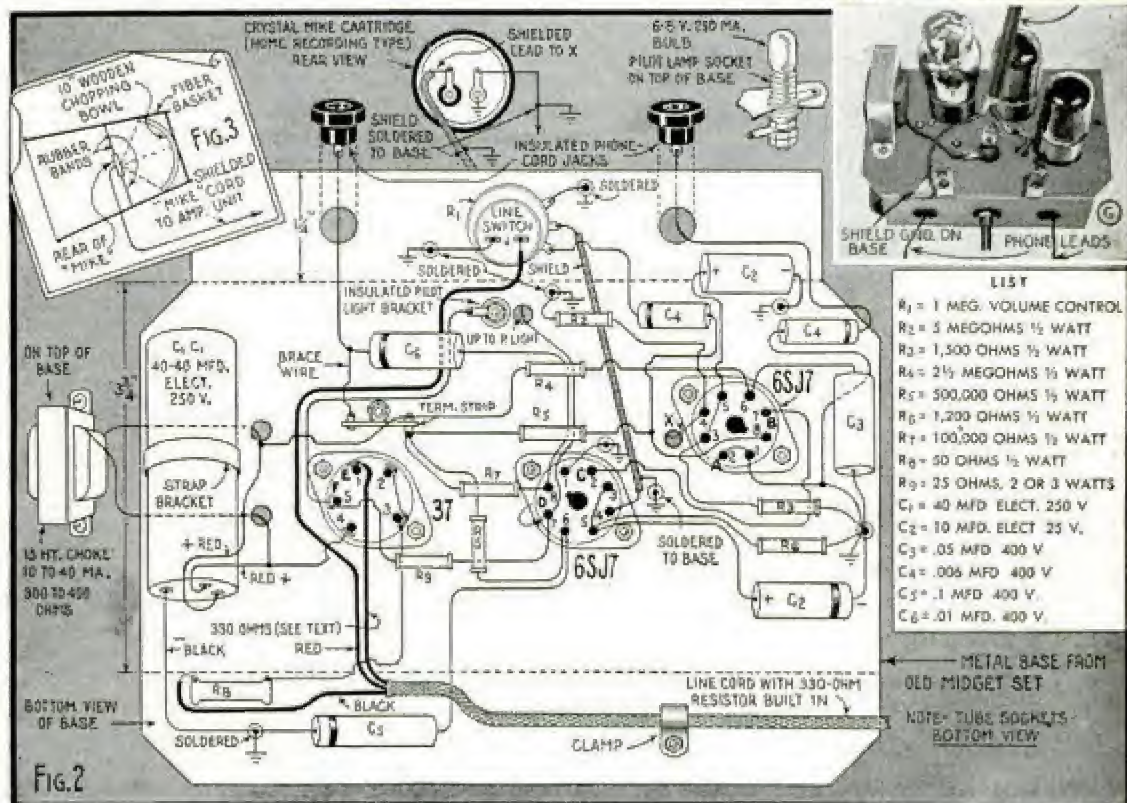
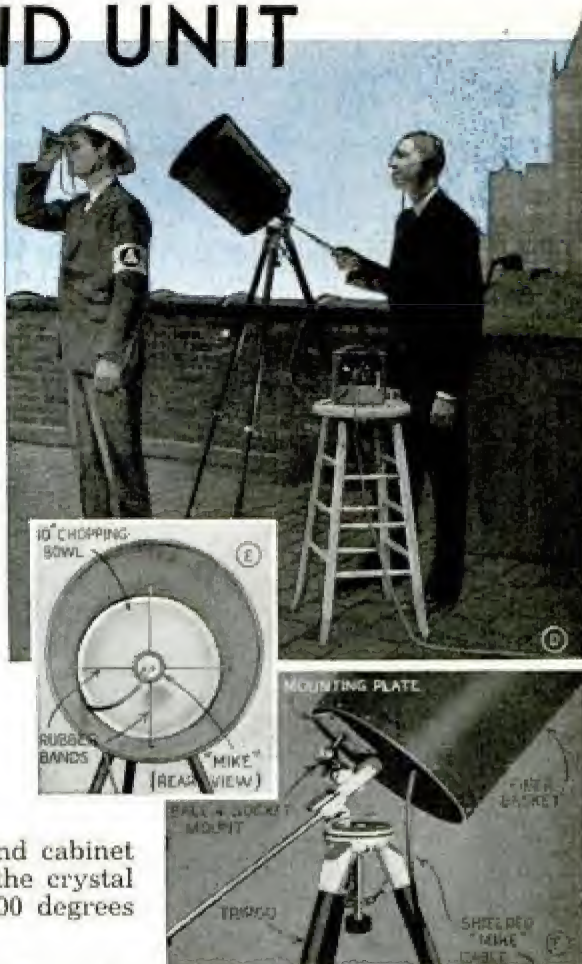
as the earphone for the device. When used in the emergency aircraft detector assembly, as in photos D, E and F, the mike is extended to the improvised horn by means of a 5-ft. shielded microphone cable connected directly to the chassis mike leads as indicated in photo G. The



or HEARING-AID UNIT

fiber waste paper basket, with the wooden chopping bowl to act as a parabolic reflector, provides some directional properties and the camera tripod with the "pan" and tilt-top head permits orientation to determine the direction of approach of aircraft. The mike is suspended by means of four rubber bands looped through small wire rings inserted in the rubber cushion ring, and these rubber bands are then brought out through holes in the sides of the "horn" to face the mike at the focal point about 5½ in. out from the center of the bowl as shown in Fig. 3. The microphone cord conducting wire is carefully soldered to the insulated lug on the mike case, the shield being connected to the ground lug.

The plywood case shown in photo A was salvaged from discarded call system and the plastic handle came from the dime store. Detailed list R-316 is available if desired, but there is no blueprint for this article. The case is 7 by 7 by 4½ in., however if the ballast tubes are substituted for the line cord resistor, as indicated in Fig. 1-A, a larger chassis and cabinet must be used to keep them away from the crystal mike as sustained temperatures above 100 degrees will damage the crystal.



Civilian War Emergency Radio Service System

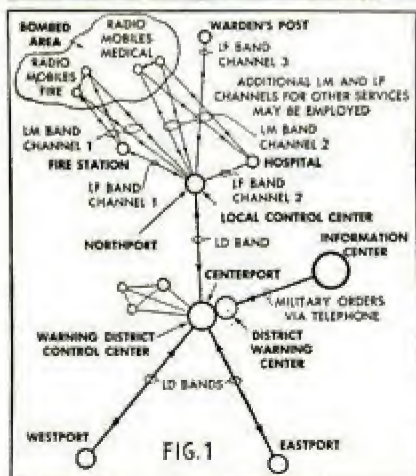


"DEFENSE Councils, particularly those in target areas, can now substantially increase the effectiveness and flexibility of their defense forces through the War Emergency Radio Service," (WERS) states OCD Director James M. Landis. The Office of Civilian Defense recommends that every community take steps immediately to give itself this added protection in case of enemy attack or local catastrophe. WERS is a new system of two-way radio communication for civilian defense in local areas. It can be set up only by specific authorization of the Federal Communications Commission, and is open to radio amateurs and others who wish to serve their country. It is a rugged, home grown, highly adaptable system of greatest use before, during, and after an air raid or other emergency.

The WERS system consists of numerous small short-wave transmitters and receivers reporting to central stations. Photo A shows two civilian defense operators at a control center receiving reports from civilian defense radio volunteers who are

operating efficient homemade mobile and "walkie talkie" portable field equipment of "junk box" construction, as shown in photos B and C. The FCC has assigned to WERS frequencies from 112 to 116 megacycles, and recommends that operations be planned for three bands of several channels each. This tripart plan is clearly outlined in diagram Fig. 1 of the district warning area. The warning district control center relays to all local control centers. The network plan will require a subdivision of the 112-116 Mc. band into frequency channels 200 Kc. apart in order to eliminate interference between networks. Each segment has its specific use; nominally they are (LD) local-district, (LF) local-fixed band, (LM) local-mobile and walkie-talkie, and Civil Air Patrol band.

OCD photos from OWI; diagram from A.R.R.L.





Guilty... OF ENGINE NEGLECT

THE finger of guilt points at the car owner who lets an automobile engine wear unduly for lack of the proper care.

Your car is a vital unit in our transportation system. Of course, tires and gasoline must be conserved, but *save that engine, too!*

Piston rings are a mighty important

factor in prolonging the life of your engine. At the first sign of ring wear, visit your motor service man and ask him to install a set of Hastings Steel-Vent piston rings. They restore engine performance, stop oil-pumping, save gasoline and check wear on cylinder walls.

HASTINGS MANUFACTURING COMPANY, HASTINGS, MICH.
Hastings Mfg. of Canada, Ltd., Toronto

TOUGH BUT OH SO GENTLE



HASTINGS STEEL-VENT PISTON RINGS

Tough on oil-pumping • Gentle on cylinder walls

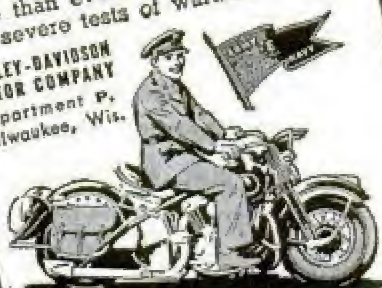
THE "Pals" THEY LEFT BEHIND



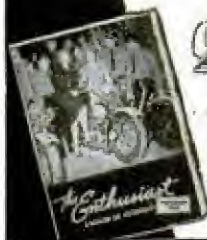
are Harley-Davidsons

Letters continue to pour in from men in the armed services telling how they miss the Harley-Davidson Motorcycles they left behind. One outstanding feature of ALL these letters is the way every man speaks of the stamina, power, and rugged dependability of his Harley-Davidson "sweetheart." And they look forward to the day when they can again thrill to the ownership of new Harley-Davidsons — motorcycles with greater performance than ever, made possible by the severe tests of wartime action.

HARLEY-DAVIDSON
MOTOR COMPANY
Department P,
Milwaukee, Wis.



Write today for your
FREE copy of "Enthusiast"
magazine, filled
with motorcycle action
pictures and stories.



HARLEY- DAVIDSON MOTORCYCLES

Industry's Mr. Fix-It

(Continued from page 37)

intermediate type of mold, one that will stand up for several castings yet not cost the prohibitive sum of a metal mold.

Two recent developments cause modest pride among the technicians. One is an induction-heat method of plating tin, which requires only one-third to one-half as much tin as is used in hot-dipping steel sheets for tin cans. The metal to be tinned is electroplated with tin, and the resulting "hills and valleys" are smoothed to a brightened surface by induction heating, in a process similar to that used in inducing artificial fever.

The other prize exhibit is a wire-recording device, so excellent that the armed services leaped for it, with General Electric commissioned to manufacture it on a mass basis. Marvin Camras, stocky, curly-headed 1940 graduate of Illinois Tech, modestly concedes:

"Well, I guess I did invent it, more or less."

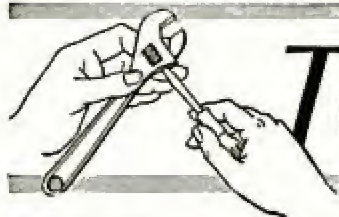
It was much more than less. Recording on wire or metal tape was done before the turn of this century, but it wasn't practical. The wire was passed through a magnetic field, and if the wire twisted in transit the recording was distorted or lost altogether. Camras simply placed his magnetic field lengthwise to the wire, instead of across it at one spot, so now if the wire twists, it doesn't matter.

The machine, called the Magnetic Wire Sound Recorder, has limitless possibilities for general use after the war. An hour's program can be recorded on one small spool of wire, and the recording can be played back almost endlessly without "wearing out." One was played back 200,000 times, with a loss in volume too small to be detected by the ear.

With a time-control unit, a postwar businessman could place his wire-recorder by the radio, and have it pick up for him automatically during the day the program he would otherwise miss while at the office. Or he could use the machine to make a speech by proxy—as one of the foundation's scientists has already done.

With a switch control, the wire may be cleared, so that it can be used again to record in the same spot. The wire itself can be twisted, bent or even fired up to red heat temperatures where the carbon-steel itself would almost melt, without affecting the recording, though it is only .004 inch in diameter, and five miles of it weigh only a pound. For a glimpse into the future of

(Continued to page 148)

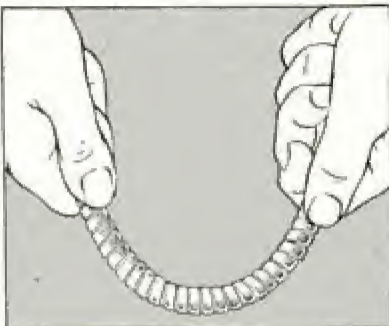


TOOL NOTES

Maintenance
and Repair
Suggestions to
Prolong Tool Life

No. 9 HOW TO CUT BX ARMORED CABLE

1. Grasp the cable with your hands as shown, either side of the point to be cut. Bend sharply until a spiral breaks open. Then reverse this procedure by . . .

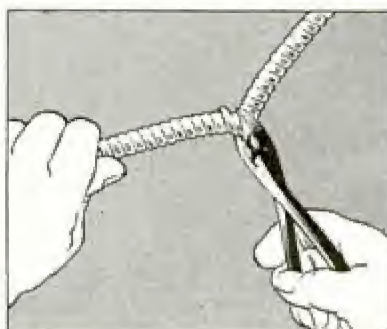
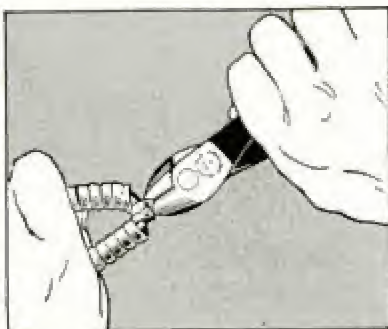


Here are two methods of cutting BX Armored Cable. Both assure a workmanlike result, and save time.

2. . . . bending the cable sharply in the opposite direction. This operation will separate a single spiral of cable. Grasp the cable close to the break and . . .



3. . . . cut the exposed and separated spiral with a pair of Crescent No. 542 Heavy Diagonal Pliers, using care not to cut the insulated wire beneath.



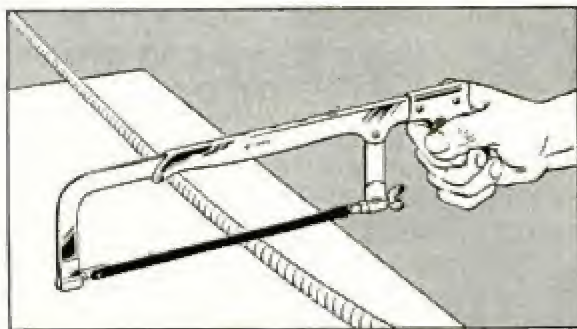
4. Now cut thru the paper insulation and wires with your Crescent Heavy Diagonal Cutters as shown. Their powerful leverage will readily sever even heavy insulated wire.

5. Last, squeeze back sharp end of the armor with a pair of Crescent's No. 1950 Linemen's Pliers and you have completed a neat, workmanlike job.



THE HACKSAW METHOD

Instead of using a pair of heavy diagonals for the first three steps, a Crescent Hacksaw may be used. Clamp the cable in a vise, and saw across one spiral at the angle illustrated, using care not to cut the insulated wire. Complete the job as explained in steps 4 and 5.



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MAIL THE COUPON for free reprints of this series of 13 informative ads.

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☐ for Bulletins ☐ for 3-ring binder

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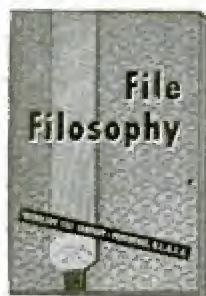
City _____ State _____



It's POP, the foreman. And is he mad! Like any good production head or conscientious mechanic, Pop knows what happens to a file when tossed among other files or tools. Even a few battered teeth can cause skips, throw the filing stroke out of stride—waste time—destroy accuracy—*reduce the efficiency and earning power of the worker.*

In Nicholson and Black Diamond files, Nicholson goes to great pains to provide the toughest, sharpest and most uniform files it is possible to produce. A moment of carelessness in their use can undo much of this great care in their manufacture.

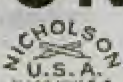
The right file for the job and Twelve perfect files in every dozen are long-standing guarantees in the Nicholson policy of providing mechanics, die makers, model builders and other craftsmen with the very best in filing aids.



SEND FOR THIS FREE BOOK

"FILE PHILOSOPHY" — the foremost book of its kind — contains interesting and valuable information on file use and care; and on many kinds of regular and special-purpose files used by modern industry. 48 illustrated pages.

Nicholson File Co., 22 Acorn St., Providence 1, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

**NICHOLSON
FILES** FOR EVERY
PURPOSE  **NICHOLSON
U.S.A.**
MADE IN U.S.A.

household entertainment, it is estimated the recorder can be profitably sold within the popular price range.

The pooling of talents at the foundation is well exhibited by work on the magnetic recorder. Camras had the theoretical idea, but into the completed machine also went the skill of a metallurgist, who specified the type of wire; carpenters who helped build the cabinet; mechanical experts who fashioned the automatic switches; other radio and electrical experts who helped Camras design the circuits; and the coordination by Dr. George Ziegler, chairman of physics research, into a complete unit commercially available to our armed forces. The entire research staff of the foundation was always available to solve problems as they arose, and their combined experience made possible in days developments that might have taken a single inventor a lifetime.

It is this pooling of talents that makes the foundation truly a good right arm for industry, and that has encouraged its growth until it has become virtually unique in the United States.

Uncle Sam Packs a Wallop

(Continued from page 43)

hydraulic controls that must be kept in almost sterile condition, yet must be packed in containers rugged enough for service at advance posts where parts may be cached under sand or water.

The familiar transparent cellulose straws, decorative cold-drink sippers, also have a wartime job. Lengths of such straws contain glass ampoules of iodine or mercurochrome for the soldier's first-aid kit.

The cellulose wrap protects the ampoule until the soldier wishes to apply the medicine. He then squeezes the straw until the glass inside breaks, releasing the medicine, which runs down and saturates a plug of cotton at one end of the straw—the straw thus becomes also an applicator.

With critical war materials destined mainly for war, the home front will use more and more packaging substitutes, no hardship when the packages are as ingenious as these, entered in the annual All-America Package Competition sponsored by Modern Packaging Magazine:

A heat-sealed cellophane envelope that dispenses one aspirin tablet at a time.

Toothpowder dispensed from a paper cone sealed with glassine.

Cigar-lighter fluid packaged in glass, with a screw-type plastic spout and a plastic resealing cap.

Spiral-wound paper "cans" in which ink,

(Continued to page 150)



You may worry
about the crowd
on the train

but here is one worry you can avoid

TRANSPORTATION, *by any means*, is really a problem these days. Take your car, for instance. Because you drive it *less*, you have a different problem than if you drove it a lot.

For idle batteries run down—idle pistons and bearings can rust from water and sludge in the crankcase—scale and rust can ruin a radiator. And tires lose air just the same.

That's why, *today more than ever*, your car requires regular Marfak 40-Point Chassis Lubrication Service!

Your dealer checks every vital point of your car against his Marfak chart. No guesswork here . . . which means accurate protection for irreplaceable engine and chassis parts.

So insist on genuine Marfak Lubrication today—to keep your car in "top" condition for the important job it does for you and Uncle Sam. At Texaco and other good dealers everywhere.



Tune in the TEXACO STAR THEATRE every Sunday night. See your local newspaper for time and station.

You're Welcome at **TEXACO DEALERS**



Immense industrial facilities throughout America are concentrated on the greatest aircraft building program in all history. In this vitally important work a wide variety of Disston tools are serving long and well at a multitude of tasks.

In many of the huge plants turning out planes you find Disston hand saws, back saws, dovetail saws, compass saws, veneer saws, coping saws, circular saws, band saws, hack saws, hack saw blades, files, mitre squares, try squares, bevels, gauges, levels, cabinet scrapers and many others.

If you need tools for essential service, see your Hardware Dealer and ask for Disston. An outstanding example of a fine Disston tool for war work is "The Saw Most Carpenters Use," the:

DISSTON D-8



Medium weight Skew-back pattern. Made in 20-inch 10 points cross-cut; 22-inch 8 and 10 points cross-cut; 24-inch 8 and 10 points cross-cut; 26-inch 7, 8, 10 and 11 points cross-cut, 5½ points rip.

GET LONGER LIFE AND BETTER WORK from your tools. Ask your Hardware Dealer for your FREE copy of the valuable Disston Saw, Tool and File Manual. Or write to us direct.



HENRY DISSTON & SONS, INC.
911 Tacony, Philadelphia 35, Pa., U. S. A.

varnish and compounds are shipped without drying out.

Paper packages, replacing tins, to contain vegetable shortening.

Wartime stay-at-homes will scarcely bemoan the absence of the familiar containers of peacetime years, because virtually all of the substitutes function well—some so well they may win a permanent place in the postwar economy. And any civilian inconvenience is minor compared to what would happen if military goods arrived at battlefronts broken, corroded or spoiled.

"The best that industry and government can do will be none too good to meet present wartime shipping hazards," a War Department official warns. But American industry is making sure its best is mighty good.

Featherweights of the Navy

(Continued from page 53)

In World War I about 100,000 depth charges were fired for every U-boat sunk, and that this war's U-boats are bigger and tougher yet, the little fellows have a big job. They include the PC boats and the newer destroyer-escorts, smaller than a destroyer but to a U-boat captain just as poisonous.

Japan has been reported trying to supplement its big warcraft with jerry-built boats similar to Chinese junks. They're even using big rafts. Against such improvisations we are matching craft that are both mass-produced and tailor-made.

But we are armed with more than production figures, paper tactics and seagoing box scores. For aboard our chip-sized vessels are men sailing in the tradition of ancestors whose tall four-masters planted the American flag in every corner of the world. Aboard the little boats as on the big ships, Americans are rediscovering the sea.

Free Meat—Come and Get It!

(Continued from page 77)

Maine lead, Wisconsin has just five, Vermont a pair, and one lonely moose wandered from Wyoming into Colorado; mountain bighorn sheep 10,168; desert bighorns 5,157; buffalo 4,980; grizzly bears—which, like the desert bighorn, have just touched an all-time low—1,243; European wild boar 1,232, and Minnesota reports just 15 surviving woodland caribou. Canada has killed off nearly all of one big herd of bison for want of forage in a wartime economy.

The Fish and Wildlife Service hopes the

(Continued to page 152)




There's Been a Big Change

● Ever wear one of those old-time bathing suits? They covered the subject well, but they wouldn't do today. There's been a big change.

An important change has taken place in tapered roller bearings, too! Heavier loads—tougher going—longer hours . . . all begged for a bearing with more rollers, to stand up better under sterner work. Tyson developed just that kind of a bearing.

More rollers, yes—Tyson has *thirty per cent* more, on the average. Size for size, Tyson users get greatly increased load capacities. What's more important, they get almost doubled bearing life.

Tyson "All-Rolls" Bearings are in tune with the times. They're tough. They're longer-lived. They carry greater loads. The big name in bearings today is . . . **TYSON!**

 **TYSON BEARING CORPORATION, MASSILLON, OHIO**

COUNT THE ROLLS • THE ROLLS COUNT

Tyson

TODAY'S HEAVY-DUTY BEARING



HOW TO CUT THREADS WITH WILLIAMS' LATHE TOOLS



FREE! WILLIAMS' TOOL DATA SHEETS

● Data Sheet No. 14 explains how to cut external threads with Williams' Lathe Tools. This, and other Data Sheets listed below, (all punched for 3-ring binder) are free. Circle the subject numbers desired on coupon.

- | | |
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| 1. Characteristics of Williams' "Superior" Wrenches. | 6. Data on Williams' "Superior" Wrenches. |
| 2. Data on Williams' Boring Tools. | 9. Saving Time with Williams' "Supersockets" |
| 3. Data on "Vulcan" Chain Pipe Tones. | 10. Data on "Vulcan" Eye Bolts. |
| 4. Data on Williams' "Supersocket" Wrenches. | 11. Data on Williams' "C" Clamps. |
| 5. Data on "Vulcan" Lathe Dogs. | 12. Use of Williams' Cutting-Off Tool Holders. |
| 6. Data on "Vulcan" Chain Pipe Vises. | 13. Use of Williams' Knurling Tool Holders. |
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more than 20,000,000 hunters and fishermen will do their duty this year and kill their own meat. Besides this contribution to the national larder there are the by-products to be recovered—deer and elk skins, animal fats, furs, feathers. Commercial outlets and salvage drives are collecting these, and even the brass from shotgun shells and cartridges is being recovered. The Fish and Wildlife Service and state game departments are urging the War Production Board to release sufficient ammunition to permit sportsmen a normal kill.

"Probably no other source of food is so easily available at such little expense to the public as is a continuing harvest of wild game," says Assistant Director Day. "It costs little to raise, is there for the taking, and if not harvested will become the source of unnecessary damage to crops and forage that should be better utilized."

"We must see that basic breeding stocks are not raided. We must make certain that the things we advocate are only those that will utilize surplus populations and will not endanger the future of the resource."

So take your great grandfather's tip. There's free meat in the woods and fields and streams. Come and get it!

The 1943 Bucket Brigade

(Continued from page 69)

elements, the safe and efficient use of hand tools, extinguishing action of sand and water on burning material, and the organization of crews and sub-crews are covered thoroughly.

Training officers provide actual practice in building control lines with hand tools and power equipment and give inexperienced fire fighters full instruction in the use and care of forest fire fighting equipment. Local protection agencies supply equipment and material for this training. All instruction is simple and positive and deals explicitly with the problems encountered in the area concerned.

One of the outstanding results of the FFFS operation has been the extending of prevention programs to farmers and ranchers, forest industries, campers and others living near or traversing forest areas. This has been possible because countless FFFS members are themselves the very people to whom, in the past, fire prevention information has been directed.

FFFS members are taught the complete fire prevention story, practice every measure themselves and, in the aggregate, comprise a larger organization for the effective dissemination of fire prevention publicity than ever before has been available.



When the Sporting Arms Industry goes to War

Whenever war threatens . . . immediately the skill, experience and facilities of the makers of sporting arms become available to our Government as an important source for producing military equipment.

As in World War I, so today the industry is proving to be a vital factor in the production of enormous quantities of essential small arms.

We at "Savage" are making Browning Aircraft Machine Guns that have won commendation throughout the world for dependable and devastating fire power. And other guns and military rifles . . . in quantities that once seemed impossible.

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SAVAGE



Our Army-Navy "E" pennant bears the white star signifying "continued determination and patriotism in war production."

When the war is won . . . you'll want this rifle

The pre-war pride of big-game hunters throughout the world . . . the "SAVAGE 99." A streamlined high power rifle with refinements in mechanism that assure unusually quick, positive and safe operation — a rifle with a consistent record of performance that is extraordinary.





BLOW TORCH COULD DESTROY HARD-TO-KILL ATHLETE'S FOOT FUNGI THAT MAY THRIVE IN SHOES AND RE-INFECTION FEET. YOU WOULDN'T USE A BLOW TORCH ON SHOES, BUT YOU CAN FIGHT ATHLETE'S FOOT IN SHOES AND ON FEET, BY USING **QUINSANA POWDER**, AMAZINGLY EFFECTIVE!

BEWARE OF SYMPTOMS
OF ATHLETE'S FOOT :- PEELING AND CRACKS BETWEEN TOES, ITCHING, SOGGY SKIN. EVEN MILD CASES MAY SUDDENLY BECOME SERIOUS!



REMARKABLE RESULTS WITH QUINSANA

74% infected before Quinsana treatment
6% infected after Quinsana treatment

2-WAY TREATMENT

CLEARED UP PRACTICALLY ALL OF THOUSANDS OF TEST CASES OF ATHLETE'S FOOT. USE **QUINSANA** DAILY FOR PREVENTION AND RELIEF. ALSO EXCELLENT FOR EXCESSIVE PERSPIRATION, FOOT ODOR.



Use Quinsana on feet daily to help prevent and relieve infection



Shake Quinsana into shoes to absorb moisture, reducing chances of re-infection



Golden Harvest of the Sea

(Continued from page 59)

their lives on the ocean bottoms and skates which resemble flying kites and are meek cousins of the deadly ray family.

Meanwhile, people who once turned their noses up at fish are now turning corners hunting fish stores that still have something in stock.

Most of them are not as lucky as Mrs. Evy Rogers, who lives in the British island of Jamaica. She was standing in her backyard recently on a bright dry, sunny day when a wet and flopping fish dropped out of the clear sky.

Accepting the fish as a gift from heaven, she soon had it in a frying pan, but the miraculous delivery of a fresh fish near her back door became a mounting mystery throughout the island, as envious neighbors spread the story.

The explanation finally came from Pan American Airways officials who said the finny traveler had hitch-hiked on the New York bound Clipper, being caught in the acute angle formed by the after-supporting struts on the plane as it took off, wriggling free over Mrs. Rogers' backyard and scoring a near miss on her skillet.

West Point at War

(Continued from page 87)

at army training camps. They receive practical training in the Armored Force School at Fort Knox, Ky., and are drilled in other branches of the service at Fort Benning, Ga., Fort Bragg, N. C., Camp Davis, N. C., and other posts. The entire corps takes part in maneuvers with regular tactical units.

During the winter term the first classmen are also taught how to abandon ship, to swim through flaming oil, the use of cargo nets and rope ladders. They learn how to handle all types of lifesaving equipment. This training, along with boxing, wrestling, fencing and jujitsu is under the director of physical training who bears the traditional title "Master of the Sword." There is also a varsity and intramural sports program, the latter known as "inter-murder" among the cadets.

Military leaders returning from the various theaters of war help to keep the cadets alert to the constantly changing picture of combat in desert, jungle or stratosphere. It is not uncommon at West Point to see a lieutenant general's car with its three distinctive stars sweep past. Among visiting speakers who have inspired the cadets are Lt. Gen. Mark W. Clark, who

(Continued to page 156)

PRECISION IN ACTION

BIG GUNS DON'T FOOL!



WHEN you're out to smash a tank concentration ten miles away, you don't hope to hit your target by merely pointing.

You make sure, by means of precision instruments, without which no long-distance weapons can be fully effective.

And by far the most widely used of all precision instruments in all operations, are binoculars.

Universal alone now makes more binoculars for the Army, Navy and Marines, and the United Nations, than the entire industry made before the war.

This is quantity production hitherto thought impossible in instruments of such high precision—much of it *made possible* by Universal engineering research. Today, outstanding accuracy in lens-making is achieved more easily and economically than ever before, *anywhere in the world*.

Hence, Universal looks forward to a new impetus in the development of photographic and optical instruments—invites you to look forward to finer-than-ever cameras, available to everyone.

PRECISION IN THE MAKING



A Soldier with strained eyes is a wounded man. Metal parts are finished for perfect alignment on special machinery designed by Universal. Practically no tolerance is permitted, for if each eye is forced to focus independently, there is strain, as incapacitating to a soldier as a bullet wound. Today's advances in precision promise finer optical and photographic equipment tomorrow.



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Dear Bud:

You'd get a kick

out of being in this outfit. It's a great gang! Most of 'em never rode a motorcycle before, but they're all fans for life now.

Hill climbs are tame stuff compared to the run over this operations course, but most of the boys are riding Indians and that's a machine built to take it. They all say Indian's dependability and easy handling give them a real feeling of confidence and safety. And by the way, wait till you see the improvements Indian will bring out after the war. Wow!

INDIAN MOTORCYCLE COMPANY, SPRINGFIELD, MASS.



BUY WAR BONDS NOW

★ ★ TO BUY AN INDIAN LATER ★ ★

stopped at the Point before his famous pre-invasion mission to North Africa; Gen. Henry H. Arnold and Brig. Gen. Laverne G. Saunders of the air corps, and Lt. Gen. Jacob L. Devers of armored force fame.

Once these generals would have been greeted with elaborate military ceremony and full dress parades. There is no time for that sort of thing today. The generals are welcomed by young men in somber cadet gray who are eager to hear "the latest inside dope." There's a job to be done now and the rugged training for that job is a lot more urgent than full dress parades. There'll be time for those parades—later.

Aleutian Springboard

(Continued from page 5)

U. S., covering a distance of some 3,000 miles.

Soon Jap antiaircraft installations made the PBY bombing expeditions extremely risky. A cloud layer hung over Kiska Harbor at about 1,000 feet, varying in thickness and with occasional breaks. The planes would dive through the holes in the clouds, sight a target, bomb it, and then quickly climb out of sight again. The Japs caught on to this eventually and concentrated their guns on holes in the clouds. Later, when Jap Zeros on floats and fast two-engined fighters were brought into the picture, the PBY's were retired to the patrol duty for which they were built. The bombing was taken over by the Army B-24's, B-26's, and B-17's. As advance bases were built, these bombers were protected by Lightning and Airacobra fighters.

Meanwhile, through the summer and autumn, Tojo's cliff dwellers continued to dig in on Kiska and Attu. They built roads and a much-bombed runway on Kiska. They even renamed the island "Narukima" which means "Ring of the Gods" if anybody cares. Their supply lines were continuously harassed by our bombers. The number of Jap troops who wintered on Kiska and Attu has been estimated all the way from 10,000 to 25,000.

But while the Japs were digging in, the Americans were pushing steadily forward through the Andreanofs—Adak, 475 miles west of Dutch Harbor; Amchitka, 176 miles farther on. Before each advance, combat scouts went ahead. The first landing on Amchitka, which is only 62 miles from Kiska, was made in September. A four-man reconnaissance group led by Lt. Col. William J. Verbeck was landed from a PBY ship. They rowed ashore in a rubber boat. When Jap reconnaissance planes flew over

(Continued to page 158)



The EVINRUDE you're doing without helped put this "big 'un" into the fight

It takes a whole flock of pleasure motors to build a single mighty outboard for service on a battle front. And in this picture of a great fighting Evinrude, there's a heap of satisfaction for the thousands who are gladly "doing without" a new motor this year.

Their motors are *here* . . . built into this greatest outboard of them all! Here is power enough to drive a fleet of average boats . . . stamina to take a terrific beating and come right back for more . . . flashing speed that means *everything* when water boils white with deadly bursts of lead and shrapnel.

Day and night they are coming off the production lines . . . motors like this one, and motors of many other types required in amphibian operations on every front. In the peacetime Evinrude you'll someday enjoy, you'll find ample and satisfying evidence of how good these fighting Evinrudes were!

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KEUFFEL & ESSER CO., Hoboken, New Jersey



they hid among the rocks, for they knew the Japs, too, had their eyes on Amchitka.

Then one gray January day a remarkable military expedition set forth. Determined to beat the Japs in the race to occupy the island, the Army collected a couple of respectable freighters, several converted transports, fishing craft, barges, and even an old sailing schooner. Holds were crammed with crates and gear and every inch of deck space was crowded with troops. The Navy threw a protecting curtain of ships and planes around this motley assortment and everybody (for once) prayed for fog and lots of it.

For days, through fog and storm and under black skies, the expedition moved westward. On Jan. 12, the men waded through icy surf in Constantine Harbor onto the dark rocks of Amchitka. The operation, under the command of Brig. Gen. Lloyd E. Jones, was without flaw. Fortunately the weather kept Jap planes grounded. Then followed four days of feverish activity. For the first 24 hours the men worked without stopping, unloading guns, ammunition, food, and putting up tarpaulin over dugouts. Four days later they had leveled off a landing strip and the vanguard of a fighting air fleet came roaring in through a hole in the clouds. Ninety-six hours later the first big bombers were landing. They had won a race that might well change the pattern of war in the Pacific.

The first air attack launched from Amchitka on Kiska must have left the Japs reeling. Big bombers dropped their eggs at mast level and the fighters shot everything in sight out of the sky. When the fighter pilots came back they were like a bunch of boys on a surprise party. One of the squadron commanders in an Airacobra wanted to go back immediately with his chosen wingman and make a two-man attack. It took some high-powered persuasion to change his mind. The only casualty on that attack was when two Lightnings collided on the tail of the same Zero.

To the men who took Amchitka, that island will always be the real springboard to Tokyo regardless of subsequent action. If that expedition had failed, it might have been too risky to launch the attack on Attu. And without Attu there would have been no pincer movement against Kiska.

Now Tojo is quaking at his naval base on Paramoshiri Island. He is tired of American surprises and haunted by the shadow of an eagle with newly-sharpened claws—a big tough bird that once found a lucky roost on the roof of the late "Blair Packing Company."

PROTECT THEIR FUTURE—
BUY WAR BONDS



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FOR EXPERIENCE



Let the Sun Peek Thru

To us, working night and day in the production of war material, this picture has a special meaning. It suggests a possible solution to a serious post-war problem—the return from violence.

We all look forward to peace as a condition that will dissipate bitter hate. But will it—really? Learned men tell us that considerable adjustment is necessary to recover the wholesome attitude, nationally, that makes for balanced living.

In an atmosphere of blue skies and open water, perspectives have a chance to straighten out. Sunshine fills the heart, as in the case of these youngsters. You who have felt the influence of golden hours on the water know what we mean. You who have not, may yet experience this deep satisfaction. We hope, quite unselfishly, that when the right day comes, you will discover the friendliness of sun-swept waters. With—or without—an outboard.

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Your car is a primary family asset and one to be conserved and preserved as such. Spark plugs are a primary source of its efficiency and economy. Cared for—inspected and tested regularly—they will help you to get maximum mileage from every gallon of your gas ration, and to keep your engine smooth and efficient. Neglected they can cause hard starting, rough engine performance, and rob you of gas mileage. Be a mileage miser—take advantage of the spark plug testing and cleaning service offered by your Champion Dealer.

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Say you saw it in Popular Mechanics!

Hot Radio Waves Weld Plywood To Make Wood Bombers

With a 300,000-watt radio thermal unit, thin sheets of birch and maple veneer are welded into a super plywood for Mosquito bombers at the Pluswood, Inc., plant, Oshkosh, Wis. Forty-five layers of veneer treated with secret chemicals are placed in a press that is seven feet wide and 18 feet long. While 5,000,000 pounds of pressure are applied, the product is subjected to intense radio heat. The radio waves heat the wood in the middle at the same temperature as the exposed surfaces. This eliminates residual stresses within the finished product, a weakness caused by old-style steam presses. Radio heat also does the job in minutes, compared with hours for steam heat. The product, called Pluswood, is so hard that metal-working tools are needed to handle it. It weighs only one-half as much as aluminum and one-fifth as much as steel. This "wood alloy" is resistant to mild acids, salt water, fire and the elements. Although the entire output is now allocated to war planes, its postwar uses may include gears, bushings, sports equipment, beams in large buildings and parts for ships.

Two-Thirds of Oil Left in Wells With Ordinary Drilling

Seventy billion barrels of oil await recovery in wells which have been worked by ordinary methods, says D. R. Knowlton, director of production for the Petroleum Administration for War. He estimates that two-thirds of the oil is left in the ground. This reserve is believed to be the most economical source of additional oil for the war program aside from new wells. During the last few years millions of dollars have been spent on exploratory drilling with only moderate success, Knowlton says, and unless old wells are pumped dry we may face an oil shortage in the future.



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Hex	1/2"	3/8"	3/16"
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Thread Length	7/32	7/32	3/32
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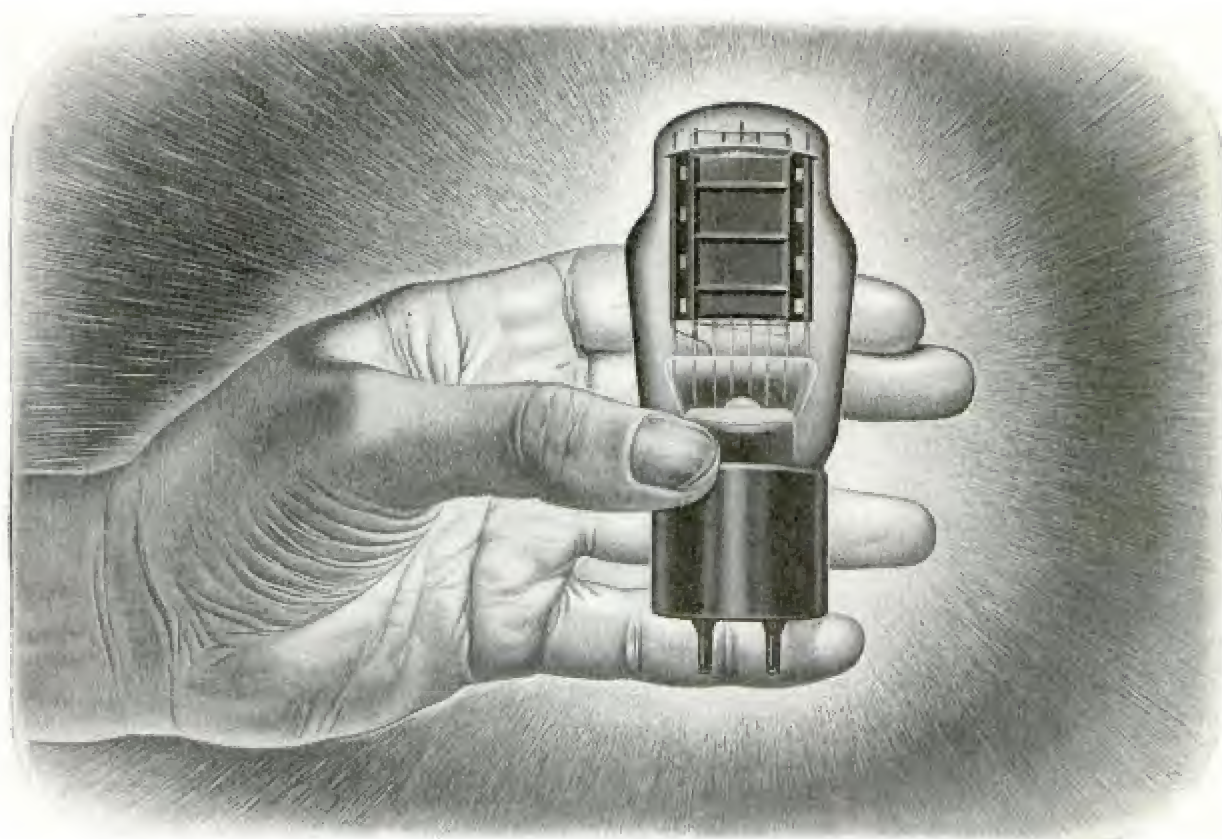
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HELP THE WAR BY MAKING ONLY VITAL CALLS TO WAR-BUSY CENTERS. THAT'S MORE AND MORE ESSENTIAL EVERY DAY.



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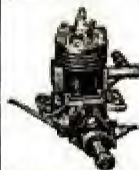
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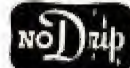
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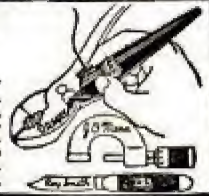


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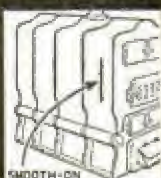
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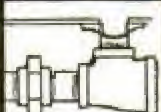


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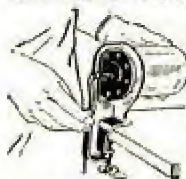
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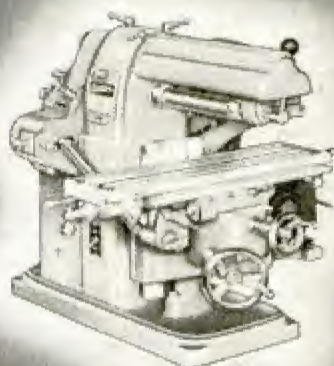
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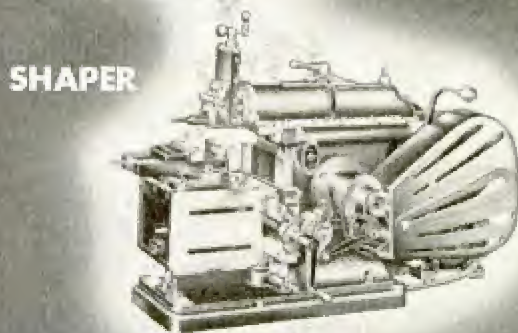
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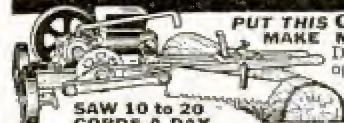
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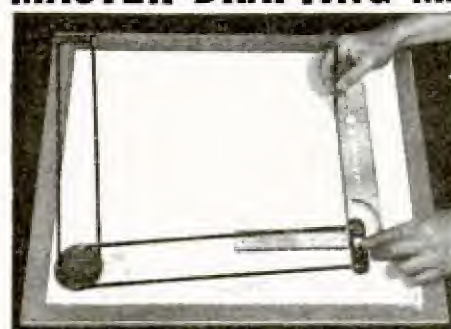


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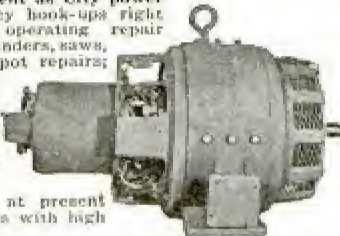
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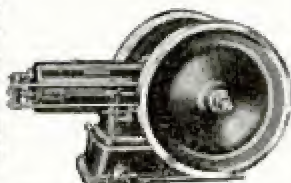
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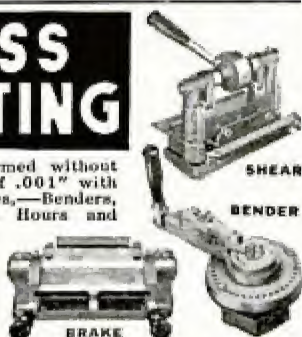
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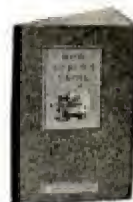
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"Aye, Aye, Sir," means that the order is understood and will be obeyed.

The Navy has given Zenith many "orders" since this war began.

Our prompt "Aye, Aye, Sir," has, we believe, been justified by the "intelligence and initiative" (as the Navy says) with which these orders have been executed.

—in days of civilian radio, Zenith was proud of its long series of "firsts"—improvements which made radio history and established leadership in the industry.

—today our viewpoint has changed—materially.

—engaged exclusively in war production, the things we have been called upon to do—the tasks we have succeeded in accomplishing, make past improvements in civilian radio literally look like "child's play."

—the work of our engineers in radionics has made the "impossible" possible and accomplished the "miraculous."

*—mark that word "RADIONICS" (with its subdivisions—Electronics, Radar and Radio)—it has brought into reality and being, devices which only a year or so ago came in the "impossible" and "miraculous" categories.

—today Zenith works in the science of radionics for our armed forces alone.

—in that bright "tomorrow" when peace returns—

—we can only say—the post-war radios that Zenith will produce will contain many interesting new developments.

—that statement is based upon experience which we can not now reveal—but you may take our word that it is a fact.

ZENITH RADIO CORPORATION, CHICAGO

BETTER THAN CASH

U. S. War Savings Stamps
and Bonds

ZENITH
•LONG DISTANCE•
RADIO
RADIONIC PRODUCTS EXCLUSIVELY—
WORLD'S LEADING MANUFACTURER

They've Got What it Takes!



THE
PLANES

THEY DIVE AT 725 M.P.H.

◆ They may not be what the doctor ordered for a quiet ride, but this new Thunderbolt fighter, built by Republic Aviation, is what the Axis asked for—and is going to get!

◆ What's it feel like? "Well," says Joe Parker (*at far right*), who tests these Thunderbolts, "when you're diving that fast, you feel like you were a part of a solid piece of steel. And when it's over, I sure enjoy a Camel."

THE
MEN WHO
FLY 'EM



THE "T ZONE"

—where cigarettes are judged
The "T-ZONE"—Taste and Throat—is the proving ground for cigarettes. Only *your* taste and throat can decide which cigarette tastes best to you . . . and how it affects your throat. Based on the experience of millions of smokers, we believe Camels will suit your "T-ZONE" to a "T."



FIRST IN THE SERVICE

The favorite cigarette with men in the Army, Navy, Marines, and the Coast Guard is Camel. (Based on actual sales records in Post Exchanges and Canteens.)



Camels

R. J. Reynolds Tobacco Company, Winston-Salem, N. C.